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ACTUARIAL SOCIETY OF AMERICA

"The work of science is to substitute facts for appearances and demonstrations for impressions."—RUSKIN.

TRANSACTIONS

1921

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NOTICE.

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256 Broadway, New York City.

October, 1921.

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NOTATION

Life Symbols.

As Revised October 11th, 1911.

Resolved, that in the presentation of papers the symbols of the Text-Book of the Institute of Actuaries, with the additions noted below, be followed when convenient, and that, in any event, the use of such symbols in other senses be avoided; all letters used as symbols to be printed in italics except "a" when used to denote an annuity of 1 first payment immediate, *i. e.* $(1+a)$; that N_x and S_x be used in accordance with the practice of the Institute of Actuaries, *i. e.*,

$$N_x = N_{x-1} = D_x + D_{x+1} + \cdots$$
$$S_x = S_{x-1} = N_x + N_{x+1} + \cdots$$

Additional symbols

$$k_x = \frac{d_x}{l_{x+1}} = \frac{C_x}{D_{x+1}}.$$

$$u_x = \frac{l_x}{l_{x+1}}(1+i) = \frac{D_x}{D_{x+1}}.$$

Disability Symbols.

As Adopted May 16th, 1912.

l_x^{aa} = the number of active lives at age x.
l_x^{ii} = the number of invalid lives at age x,

then $l_x^{aa} + l_x^{ii} = l_x$.

l_x^{i} = the survivors at age x in a mortality table based on invalid lives (not to be confused with l_x^{ii} amongst whom there are additions each year from those just disabled).

d_x^{aa} = the number dying as active lives between ages x and $x+1$.

d_x^{ii} = the number dying as invalid lives between ages x and $x+1$.

i_x = the number of active lives becoming invalid between ages x and $x+1$.

p_x^a = the probability of an active life aged x being alive one year hence, whether then active or invalid.

q_x^a = the probability of an active life aged x dying within a year, whether still active or after becoming invalid,

$$\text{then } p_x^a + q_x^a = 1.$$

p_x^i = the probability of an invalid life aged x being alive one year hence.

q_x^i = the probability of an invalid life aged x dying within a year,

$$\text{then } p_x^i + p_x^i = 1.$$

p_x^{aa} = the probability of an active life aged x being alive and active one year hence.

p_x^{ai} = the probability of an active life aged x being alive but invalid one year hence.

q_x^{aa} = the probability of an active life aged x dying while still active within a year.

q_x^{ai} = the probability of an active life aged x becoming invalid and dying within a year.

r_x = the probability of an active life aged x becoming invalid within a year,

then $p_x^{aa} + p_x^{ai} = p_x^a$; $q_x^{aa} + q_x^{ai} = q_x^a$; $p_x^{ai} + q_x^{ai} = r_x$; $p_x^{aa} + q_x^{aa} = 1 - r_x$; $p_x^{aa} + p_x^{ai} + q_x^{aa} + q_x^{ai} = 1$.

r'_x = the absolute annual rate of invalidity,

$$\text{then } r'_x = \frac{i_x}{l_x^{aa} - \frac{1}{2}d_x^{aa}} = \frac{r_x}{1 - \frac{1}{2}q_x^{aa}}.$$

$D_x^{aa} = v^x l_x^{aa}$.

$D_x^{ii} = v^x l_x^{ii}$.

$D_x^i = v^x l_x^i$.

a_x^{ai} = value of an annuity payable at the end of each year

provided an active life now aged x is then alive but invalid.

$\mathbf{a}_x^a$ = value of an annuity-due on an active life payable during survival, active or invalid.

$\mathbf{a}_x^{aa}$ = value of an annuity-due on an active life payable during activity.

$\mathbf{a}_x^i$ = value of an annuity-due on an invalid life.

${}_n|\mathbf{a}_{xi}^{a(\overline{t}|)}$ = value of a deferred temporary annuity payable at the beginning of each of t years deferred n years, provided the disability occur during the n years.

$\mathbf{a}_{x:\overline{n}|:\overline{y-x}|}^{aa}$ = value of an annuity-due on an active life for n years or for $y-x$ years, whichever is the shorter, during activity.

Vol. XXII, Part One. No. 65

TRANSACTIONS

MAY 19TH AND 20TH, 1921.

Address by the President, William A. Hutcheson.

Some of Our Society's Activities.

Our Meetings.

Since its inception, the Society has held semi-annual meetings, and for many years these meetings have extended over a day and a half.

With the smaller number of members this time was found sufficient, until recently, to transact all the necessary business of the Society, including the reading of new papers and the discussion of those presented at the previous meeting. But with the recent increase in membership, and with the introduction of the "Question Box," a day and a half is too short a time for the orderly transaction of our business.

This was impressed upon all of us very markedly at our meeting last October, because we then had to discuss two sets of papers, owing to the overlapping of the old and the new systems. It seemed impracticable to extend the duration of our meetings; therefore, some plan of transacting the business of the Society within the time at its disposal had to be devised. I sought advice from the Council, and one kind, practical member suggested that if, at the annual meeting in May, the President availed himself of the option of making a few remarks, instead of delivering an address, the problem might be solved. It was good advice, and I shall follow it today and limit my remarks to a statement regarding our Society and some of its activities.

Another suggestion, which is being carried out at this meeting, was that time might be saved if we divided the papers into two classes: first, those suitable for discussion at our meeting; and, second, those of interest to the Society, but not suitable for immediate discussion. Five papers of the first class will be read, in abstract, and discussed at this meeting, and five other papers of the second class will merely be printed in our *Transactions*. Members desiring to discuss these last papers should send written comments thereon to the editor for publication in the *Transactions*.

Papers.

The new system, of discussing papers at the meeting at which they are presented, is now being given its first real trial. Some favor it, others consider the old plan the better. We are fortunate in having excellent papers presented on this occasion, and it is hoped that as many as possible will join in the discussions, so that the new plan may be given a proper test. In this way only can it be decided which is the more suitable plan for our Society; but it should be remembered that the galley proofs of the papers for this meeting were somewhat delayed through circumstances over which we had no control.

Another slight change in our program is being tried at this time, namely, the calling of our morning meeting today for half an hour earlier than usual. I trust it has not inconvenienced many of you.

There is one more or less radical change in our program for this meeting, of which you have all had notice, namely, the substitution of the "Informal Discussion of Topics of Current Interest" for the old "Question Box." Actuaries have always been interested in a thousand and one different topics, but only a few of these topics were ever covered by the papers read or discussed at any one meeting. We plied each other with questions of all sorts and it has been generally admitted that the principal benefits of attending our meetings are due to the coming in personal contact with our professional brethren from all over the country, the casual asking of questions, and the interchange of opinions and information. The introduction of the "Question Box" some years ago arose from a desire to pool, as it were, all these individual interviews and thus circulate the combined wisdom of the many throughout our whole membership. All members were asked to send in questions; those in charge of this

Informal Discussions.

part of our program sifted these questions and endeavored to have each question answered by at least one member. This plan worked fairly well, but as the members in general never knew beforehand what topics would be discussed, they were unable to look into the subjects before coming to our meetings.

Some one proposed that we invite the members, as before, to suggest suitable topics for discussion, but that they be sent in early enough to enable a list of those selected to be prepared and mailed to each member prior to the meeting. This, as you know, has been done for this meeting, and part of our time on this occasion will be devoted to the "Informal Discussion of Topics of Current Interest."

I would like here to interpolate a few remarks regarding the writing of papers and the suggesting of topics for discussion. I have always felt that the Society was under a deep debt of gratitude to those who write papers for its meetings, because the preparation of a paper entails much labor and thought and the expenditure of a great deal of time. Regarding topics of current interest suitable for informal discussion, we all come across them almost daily in our office work. Why not write them down there and then and send them to the Secretary for the next informal discussion? As contrasted with the writing of a paper, this requires little labor, almost no time, and surely a modicum of thought! At this point I want to call your attention again to the facts that, on the one hand, five members prepared papers which will be discussed by us at this meeting, and that other five prepared papers which will be printed in our *Transactions,* and that, on the other hand, eight members (or groups of members) suggested subjects for discussion—good subjects—and our thanks are due to them for this part of the program.

Incidentally, several of the members suggested "Life Insurance without Medical Examination" as a live topic, but, fortunately, two of our members prepared papers on this subject. The majority of the topics suggested had to do with disability benefits and accidental death benefits, which accounts for the major part of the program, drawn up by a committee of three, dealing with these subjects.

To return, however, to the ten papers and the eight suggestions, of the 100 odd members who are here today, ten did all the real work, and only eight were interested enough in our proceedings to

suggest topics for discussion. And yet I am told that the informal discussions are found the most interesting part of our meetings!

The time given for the informal discussions will enable about 40 members to participate at the rate of three minutes per person, and as I have not invited any member directly—but all of you indirectly—to take part in this part of our program, there will be an opportunity for about half of you to redeem yourselves for your previous lack of interest.

I am emphasizing these facts in the hope that a greater number of our members will in future suggest topics for our informal discussions. The question might well be asked, Are you a member of the Society for what you can give to it, or are you merely interested in what you get out of it?

Finally, I want to remind you that these discussions are confidential; that they will *not* be printed in our *Transactions,* and that they are *not* for publication.

Our Examinations.

Another topic on which I wish to make a few remarks is that of our examinations. At the meeting in Richmond last October I referred to the average time taken by students to become Associates and thereafter to graduate as Fellows. The average time taken seemed discouragingly long from the student's point of view, but I doubt whether the average student can absorb the subjects thoroughly within a shorter period.

What I had to say regarding the average time taken was not without results. First, at our Dinner, and then at our Council meeting, the matter was commented on, and resulted in a committee being appointed last October, with Mr. Robert Henderson as Chairman, to look into the whole question of our examinations. The Council approved of the committee's recommendation that it would be well, in the case of Parts I and II of the Associateship Examinations, to define more clearly the scope intended to be covered in the subjects prescribed for these examinations in the syllabus. These recommendations are set forth in the circular of February 28, 1921, entitled "Associateship Examinations—Parts I and II," and this year's examination papers will doubtless reflect these recommendations. It is hoped that they will result in a greater percentage of our students being successful in these first two examinations hereafter.

The Committee and the Council did not consider that it was

desirable to make any recommendations regarding the examinations subsequent to Parts I and II.

It will surprise most of you to be told that 282 individuals have made application to take our examinations, which are being held next week. As 98 of the 282 will take two examinations each, the total number of separate examinations taken will be 380. We have arranged for these examinations being held in 35 different cities.

Only those who have been on the Examination Committees can appreciate the work which lies ahead of our examiners for some time to come and the debt of gratitude which the Society owes to them.

Actuarial Education—A New Departure.

While on the subject of examinations, it doubtless will be of interest to you to know of a new departure in actuarial education which has been carried out by the Faculty of Actuaries in Scotland in conjunction with Edinburgh University.

It had been suggested that Edinburgh University should institute, in connection with its Degrees in Science, a Degree in Actuarial Science. In 1918, the Council of the Faculty considered that it was "more important to provide a better mathematical training for their junior students than a complete course embracing the whole of the advanced work in Actuarial Science," and advocated a two years' "part-time" course in Edinburgh University and the granting of a "Diploma in Actuarial Mathematics." The Council drew up a Draft Syllabus, in conjunction with Professor Whittaker of the University, and in doing so they stated that one of the objects they kept in view was "that it is of more importance that a student should have a good grounding in the fundamental subjects of mathematics that are essential for an Actuary, rather than a knowledge of the more advanced mathematics, which perhaps only one Actuary in a hundred may ever make use of."

The Council recommended that actuaries nominated by the Faculty should conduct some of the lectures—the others being conducted by the University professors—and that the Faculty should be equally represented with the University on the Diploma Committee, the diploma being granted jointly by the University and the Faculty, and, finally, that holders of the diploma should be exempted from Parts I and II of the Faculty's examinations, as their proposed joint syllabus more than covered the ground of Parts I and II of the Faculty's syllabus.

In June, 1919, the president of the Faculty announced the completion of the arrangements with the University, and in June 1920 the appointment of two Fellows of the Faculty to give instruction in purely actuarial subjects and of one other Fellow as an examiner in these courses, was announced.

I wish to call your attention to another matter which was decided at the annual meeting of the Faculty in June, 1920. The members then agreed to grant the Council power to dispense with the first or purely mathematical examination for a student who had taken a degree in mathematics at any university approved by them.

It will be of interest to you to know what our Society has attempted along somewhat similar lines. In May, 1918, a committee was appointed, with Mr. Arthur Hunter as Chairman, *to establish relations with universities.* Our committee interviewed the Yale, Harvard and Columbia authorities, with the object of urging them to make provision for actuarial students taking Part I of our examinations during their freshman and sophomore years. There was not sufficient demand for the course in Yale at that time to justify its being established. Harvard already had a post-graduate course on insurance and was unwilling to make it an undergraduate course. Later on, the Harvard "School of Business" suggested establishing an actuarial course, in which the Society was to furnish the lectures for the fellowship examinations. This suggestion came to naught, partly because the University authorities looked to the companies to endow the course for some years. As a result of the committee's efforts, Columbia is endeavoring to furnish an insurance course on more mathematical lines than formerly.

Of course we, on this side of the Atlantic, have difficulties of distance to contend with, which do not exist in Edinburgh, for about half of the students in the Faculty are resident in Edinburgh, almost within walking distance of the University.

The Educational Committee.

You have recently received notice of the publication, under the supervision of the Educational Committee, of the "Problems and Solutions, Associateship Examination, Parts I and II—1915 to 1919." This book contains a complete solution of each of the questions given in these examinations for the five years mentioned. It should be of great assistance to those preparing for these examinations, and I trust that all intending to take these examinations will avail themselves of this great aid. The Actuarial Society at large

and the coming generation of actuaries are under a deep debt of gratitude for this excellent piece of work prepared by the Educational Committee.

Lectures to Associates.

The Society is under a further obligation to the Educational Committee for arranging the lectures for fellowship candidates, and to the Fellows who have given these lectures during the last week. We trust that those attending these lectures have been greatly benefited by them and that the lectures will assist them to pass the examinations which will be held next week.

Actuarial Studies.

A few months ago announcement was made of the publication of the fifth of the Actuarial Studies prepared by the Society's Committee on Actuarial Studies. This volume, entitled "Total Permanent Disability Benefits in Relation to Life Insurance," covers in a brief way a general description of disability provisions, practical questions connected therewith, the statistical sources of and construction of tables, and formulae for the calculation of premiums and reserves. It should be in the hands of every member of our Society, and the Society owes a deep debt of gratitude to the principal contributor, Mr. Arthur Hunter, and to associate contributor, Mr. Mervyn Davis, for the preparation of this text-book.

The Joint Committee of Medical Directors' Association and Actuarial Society.

This committee, as you know, consists of twelve members—six from the Medical Directors' Association and six from the Society. The committee, has published two pamphlets, the one entitled "Standard Mortality Ratios Incident to Variations in Height and Weight among Men," and the other "Functional Heart Murmurs and Intermittent Albuminuria." The committee has ntly been considering the "Influence of Family History on Longevity," and may at some future date report on this subject. The Society's thanks are due to this joint committee for the excellent work which it has done.

Canadian Conference of Vital Statistics.

References have been made recently in the *Transactions* to the work of various committees appointed to assist federal, state and city Governments, and various organizations. Such a committee, which was appointed in 1918 to attend a Canadian Conference on Vital Statistics between the Representatives of the Dominion and Provincial Governors, consisted of Messrs. A. B. Wood,

D. E. Kilgour and H. H. Wolfenden. The report on this conference, published in October, 1918, will be found in the Society's Library.

The Society's Finances.

The last number of our *Transactions* gives a summary of the Treasurer's Annual Reports for the twenty-four years from May 1, 1896, to April 30, 1920. The accounts for the first seven years of the Society's existence have not been found, although diligent search has been made therefor.

A glance at these reports will show that the Society's receipts are derived largely from members' annual dues, the sale of our various publications, examination fees, and advertising, and that its disbursements are made principally for printing our *Transactions* and other publications, and for examination and office expenses.

The increased costs of all sorts from which we have suffered during the last few years were affecting our ability to meet our expenses out of our current income, and a committee was appointed last October to suggest means to alleviate these conditions. By a moderate increase in the price of our *Transactions* and an extension in advertising on the part of the companies represented in our membership, we trust the difficulty has been solved without recourse either to increasing our annual dues, or to selling any of our securities.

The Society's investments consist of $16,000 par value of bonds, which we are carrying in our books at cost, namely, $15,536.78. The present market value of these bonds is some $3,000, or about 20 per cent., less than their cost, and reflects present market values of good bonds. We are under no immediate necessity to sell any of them, but it is desirable that this depreciation should not be lost sight of.

Associates' Biennial Prize.

This prize, as you all know, was intended to be given biennially for the best paper presented to the Society on some subject to be suggested by the Committee on Papers or approved by it, and written by an Associate, or by a Fellow who had been an Associate within two years prior to the presentation of his paper. It was last awarded for the best such paper presented in the four semi-annual meetings ending with that in May, 1918. During the war few papers were presented by such members, and it was decided to make it a triennial instead of a biennial prize on this occasion by extending the time so as to make papers presented at the November, 1920, and May, 1921, meetings eligible, as well as those presented at the four preceding

semi-annual meetings. The Committee on Papers has adjudged that the best such paper presented at these meetings is the paper of Mr. Valentine Howell, entitled "Two Graduations of the American-Canadian Mortality Experience," which was read at the May, 1920, meeting. I therefore take great pleasure in announcing the result and in congratulating the winner. May he live to write many other papers for our Society.

Conclusion.

Just another minute, and I shall bring these discursive remarks to a close. The Society's operations may be divided, for my present purpose, into three parts. The first of these has to do with our annual examinations. Our semi-annual meetings may be considered the second, and the third is the work done by the various officers and committees throughout the year.

We all, either in the past, present or future, knew, know or will know something of the examinations, so that I need offer no apology for my remarks on this subject.

It has been our earnest endeavor to make our semi-annual meetings a success, so that it was incumbent on me to explain the somewhat changed program for this meeting.

Few outside of the Council, I am sure, have any adequate knowledge of the work done for the Society—sometimes by the members of the various committees, often by the treasurer and editor, and nearly all the time by the secretary—which is my reason for narrating some of the work done for our Society by these various committees and officers.

I want here to acknowledge my indebtedness to them, one and all, and, further, I shall take upon myself to thank them thus publicly on your behalf for the work which they have done and are doing.

Mr. Nichols' Death.

Before entering on the further business of this meeting it is only fit that reference should be made to the great loss which the Society has suffered through the death of our esteemed fellow-member, Mr. Walter Smith Nichols, and that tribute should be paid to his memory.

Mr. Nichols was one of the oldest members of the Society and during the long period of his membership he took a keen interest in all its affairs, contributing many papers and taking an active part in its discussions, as the pages of our *Transactions* will testify.

A year ago he contributed his last article—one on William Lenhart—and in commenting on that article last May, I expressed the hope that Mr. Nichols might long be spared to make journeys into uncharted lands, and that it might please him to lay the fruits of his toils before us.

He has now crossed the bar and journeyed into that land from which there is no return.

Mr. Gore has written a minute regarding Mr. Nichols, which I will now ask him to read.

Walter Smith Nichols.

Walter Smith Nichols, a distinguished Fellow of the Actuarial Society, died February 9, 1921. Mr. Nichols joined the Society in October, 1889, at the first meeting after it was founded. Thrice a member of the Council and vice-president from 1910 to 1912, he was always an active, interested and useful member. A keen thinker and a gifted speaker and writer, his contributions to the Society were listened to with deep interest, whether philosophical, historical or in the realm of pure mathematics, where his was a master mind.

Mr. Nichols was a descendant of one of the founders of Newark, where he was born November 23, 1841, in the house which had been the home of four generations of his family. He was a member of the class of 1863, Princeton University. After engaging in the study of law for a few years, his taste for mathematics led him to connect himself with a life insurance publishing house. At the time of his death he was Vice-President of the Hine Insurance Publishing Company. He was a recognized authority on insurance law and the author of various works on the subject.

But Mr. Nichols was more than a speaker, writer or scholar. He was a lover of music and of art, an enthusiastic yachtsman, a thorough patriot, and, perhaps best of all, a warm-hearted, genial friend. He will long be missed from our councils.

Dr. Sprague's Death.

It is not usual for us to take notice of the coming and going of actuaries not directly connected with our Society, but the actuarial profession at large has lost, during the last year, one of the greatest actuaries of all times. It would not be right, therefore, if we let this occasion pass without some appropriate reference to the great work done by the late Thomas Bond Sprague.

Some of us had the pleasure and the benefit of personal acquaintance with this great actuary. One of us thus favored was

Mr. Henry Moir, and I shall now call upon Mr. Moir to tell us something of the late Dr. Sprague and of what he did for the development of actuarial science during his long and active career in Great Britain.

Thomas Bond Sprague.

Since the date of our last meeting one of the greatest actuaries that the world has known died of pneumonia, on November 29, 1920—Thomas Bond Sprague.

He was born in London, March 29, 1830, and was a senior wrangler at Cambridge, England, and a fellow of St. John's College. After some years spent in life insurance work in London he became manager of the Scottish Equitable Life Assurance Society in Edinburgh, a position which he held for nearly thirty years. He was president of the Institute of Actuaries, London; also president of the Faculty of Actuaries in Scotland. The University of Saint Andrews honored him with the degree LL.D., and he was also a Fellow of the Royal Society of Edinburgh, as well as a member of several other scientific bodies.

It is by his writings that Dr. Sprague is best known, and there was no subject affecting life insurance in which he became engrossed, no route which he surveyed, but that his clear vision and penetrating investigation yielded light to others, so that the path was made easier for them to follow.

The breadth and extent of his writings can be seen by a glance at an index of actuarial literature. Perhaps his best known work dealt with mortality amongst insured lives, especially the development of select life tables. He produced new and original processes for handling the experience of companies; his contributions on this subject beginning about fifty years ago, while his more recent contribution on "The Tabulation of the Facts Extracted from the Records of a Life Office" dealt with a similar problem by a modern and up-to-date method, now generally approved. In the first case he showed originality in handling facts which were supplied by others; in the second he showed how to obtain accurate facts and thus secure the best results. Incidentally he developed an original mathematical formula of interpolation.

He was probably the first to explain clearly the mode of constructing mortality tables which show a double decrement. He did this in dealing with the subject of "Marriage and Mortality." The same general principle is applied to many other subjects, as, for example, Disability Tables, now so commonly used in this country. The scientific principles are the same. He wrote upon such diverse subjects as Premiums; The Proper Measurement of Expenses; The Valuation of Liabilities; Legislation; Life Insurance Accounts; The Limitation of Risks; Rates of Marriage Among Widows, Widowers, and Others; Probability as to the Birth of

Issue; Graduation; Division of Surplus; Liquidation and Reconstruction of Companies. On all of these subjects his works can still be profitably perused by the student who wishes to train himself properly in actuarial science.

Dr. Sprague was also one of the first, if not the first, writer in English to approve a method of Preliminary Term Valuation as a means of making due allowance for the initial expense at which life insurance is written. He brought this subject to the notice of British actuaries in 1875 and the subject is still an important one in all parts of the world, calling for careful study and thoughtful legislation. Dr. Sprague's views remain today sound and accurate, as they were when first put forth.

For nearly twenty years Dr. Sprague was living in retirement; during a good part of the time he still used the microscope in the study of insect life, and amused himself with various mathematical diversions.

The memory of Dr. Sprague will be held in reverence and esteem by all who knew him because of his unswerving loyalty to truth and duty, and of his generous help, not only in scientific research, but in more direct and personal ways towards those whose character and ability he approved. He was occasionally an unsparing critic; and some smaller souls would resent a frank expression of adverse opinion. When his opinion was given, it was usually stated without any reservation, and certainly without any temporizing or dallying with the truth. His calm statement of a fact was put forth without any apparent personal feeling, and such petty thoughts as arise from envy or jealousy seemed to be far removed from his ken. His serene and unruffled temperament earned the respect of all who met him and studied his works, and doubtless it contributed to the peaceful evening of life which merged slowly into the night. And as the darkness is needed to make visible the grandeur of the universe, so may we hope that he has entered upon a wider and happier vision.

On Some of the Problems of the Smaller Life Insurance Companies.

BY

W. R. HALLIDAY.

Recent years have seen the formation of a number of new life insurance companies. While many of these have disappeared others are flourishing and in a fair way to become permanent.

It is here assumed that the younger companies are stock companies and the problems are here discussed from the point of view of a company starting with a capital of $100,000 and a surplus of equal amount. The stock selling and formation expenses are assumed to have been provided for over and above.

With such limited resources only a small amount of business can be written on a non-participating basis. The interest basis should not be more than 3½ per cent.

Personal.

The personal element causes more trouble in a new company than any other. A new company has no resources with which to pay fancy salaries. On the contrary it must frugally conserve all its means if it is to succeed. Two officers it must have: one, inside, responsible for the Home Office work and doing much of it in person; the other should spend his time in the field, writing business and getting agency forces at work.

The clerical force should not exceed one to each 1½ millions of business in force. Less than that number should be enough if they are reasonably efficient. In this line, as in most others, it is true that cheap labor is the dearest and expensive labor the cheapest. When an office is large enough much of the work can be reduced to routine and some cheaper help employed, but in the early days of a company every man should be more than worth his salary.

A frequent mistake is to try to do without an actuary, copying the rate book, policies, forms and practices of the older companies. As Mr. Cathles says in his admirable paper submitted to the American

Life Convention in September, 1911, "It is impossible to successfully play the game if you do not pay attention to the rules." The field Superintendent, the Medical Director and the Actuary must be competent, experienced and reliable.

Reserve Basis.

No new company, unless it has an unusually large capital and surplus, can commence on the Net Level Basis. Assuming the American $3\frac{1}{2}$ per cent. standard, what form of preliminary term should be adopted?

Bound up with this question are other two:

(1) How much business can we write?
(2) What are the maximum commissions we can pay?

Many insurance men do not understand the close connection of these three questions. They have already been ably dealt with by Mr. Cathles in the paper just referred to. When the reserve basis and the maximum field expense have been fixed after a conference with the actuary, the company may be encouraged to write all the good business it can at that figure. It is exceedingly unlikely that it will exceed a safe maximum volume.

By way of developing this subject still further, some comparisons are submitted herewith, on the same data as used by Mr. Cathles, on four different bases, and with two modifications:

(1) AM Select mortality has been used for finding the actual death claims;
(2) A renewal commission of 5 per cent. per annum has been allowed up to the tenth year, inclusive.

For the sake of completeness the full data are repeated here:
All policies issued at age 35 for $2,000 each.

20 Payment Life,	60 per cent.; annual prem.,	$30.30 per $1,000.
Ordinary Life,	30 per cent.; annual prem.,	22.30 per 1,000.
20 Year Endowment,	10 per cent.; annual prem.,	43.90 per 1,000.
	100 per cent.; all non-participating.	

Rate of Termination, including deaths:

1st year	30 per cent.
2nd to 5th year	5 per cent.
6th year	4 per cent.
7th year	3 per cent.
8th to 10th year	2 per cent.

Interest realized, 5 per cent. net on all company's funds.

Reserve Basis: American 3½ per cent.

Surrender Charge: 1st and 2d years, entire reserve; thereafter $5 per $1,000.

First Year's Agency Expense: 80 per cent. of 1st year's premiums (not exceeding 80 per cent. of the 20 Payment Life rate).

Cost of Medical Examinations and Inspections: $6 for each $2,000 policy.

Home Office Expenses:

1st year	$24,000
2nd year	22,000
3rd year	26,000
4th year	30,000
.....	.....
10th year	54,000

It is assumed that $3,000,000 of new business will be written each year.

Four different bases have been selected for this comparison:

Illinois,
New Jersey, 1920,
Straight Modified Preliminary Term,
Select and Ultimate.

The table on page 16 shows the amount, on each of these bases, at the end of each year up to the tenth, of

(1) The Policy Reserves,
(2) The balance of Capital and Surplus,
(3) The total funds.

It will be observed that the total funds at the end of the 10th year, on the four bases, are:

Illinois	$2,029,702
New Jersey	2,029,389
Mod. Prel. Term.	2,017,158
Select and Ultimate	1,992,558

In other words, the more severe the basis of valuation of a new company the less funds it will have at the end of the first ten years. This is due to the larger sums paid to policyholders who withdraw during that period.

On the other hand, too low a reserve basis is likely to lead to less economy in the management.

End of Year.	Illinois.	New Jersey, 1920.	Mod. Prel. Term (O. L. Basis).	Select and Ultimate.
		Reserves.		
1....	$ 16,836	$ 17,061	$ 33,435	$ 41,904
2....	69,329	69,864	97,116	117,978
3....	159,288	160,284	197,286	234,072
4....	284,259	285,855	331,548	385,887
5....	441,828	444,150	497,553	569,415
6....	630,138	633,303	693,504	781,764
7....	848,262	852,393	918,537	1,021,845
8....	1,098,522	1,103,754	1,175,118	1,292,400
9....	1,382,679	1,389,153	1,465,068	1,595,382
10....	1,700,625	1,708,479	1,788,285	1,930,692
		Capital and Surplus.		
1....	$ 175,822	$ 175,597	$ 159,223	$ 150,754
2....	168,025	167,490	140,238	119,376
3....	166,752	165,750	128,510	91,295
4....	171,218	169,601	122,965	66,871
5....	181,540	179,175	123,687	47,828
6....	197,709	194,465	130,649	35,310
7....	220,850	216,594	144,989	30,866
8....	250,704	245,293	166,392	34,102
9....	286,648	279,932	194,324	44,310
10....	329,077	320,910	228,873	61,866
		Total Funds.		
1....	$ 192,658	$ 192,658	$ 192,658	$ 192,658
2....	237,354	237,354	237,354	237,354
3....	326,040	326,034	325,796	325,367
4....	455,477	455,456	454,513	452,758
5....	623,368	623,325	621,240	617,243
6....	827,847	827,768	824,153	817,074
7....	1,069,112	1,068,987	1,063,526	1,052,711
8....	1,349,226	1,349,047	1,341,510	1,326,502
9....	1,669,327	1,669,085	1,659,292	1,639,692
10....	2,029,702	2,029,389	2,017,158	1,992,558

The capital and surplus on the Illinois and New Jersey bases reach a minimum amount at the end of the 3d year, and the amount suggests that if the given conditions prevail a larger volume of new business can be written. It must, however, be kept in mind that the cost per million of new business tends to rise until, even if the surplus will permit it, such new business will cost more than it is worth to the company.

When we turn to the third column of "Capital and Surplus," we find that on the Straight Modified Preliminary Term plan the surplus reaches a minimum of $22,965 at the end of the 4th year. This is rather too low and it indicates that less than three millions per annum can be written on this basis with safety.

When we consider the last column we see that the Select and Ultimate basis cannot be adopted by a new company. Even a participating company could not hope to declare a dividend for the first ten years on this basis.

It is interesting to notice that at the end of ten years a company which started out on the Illinois standard can quite easily change over to the Modified Preliminary Term basis for all its existing business, and later on could raise its reserve standard still higher.

It should be here repeated, that all the elements in this problem—Mortality, Interest, Field Expenses—vary considerably in different parts of the country. Each company, therefore, presents a separate problem for study by the actuary, and no rule can be laid down for general application.

Maximum Size of Policy.

A frequent question put by the officers of a new company is: How much can we insure on a single life? If they are inexperienced a safe reply is, $2,500 the first year. With such officers, mistakes are going to be made, and it is well to have them made on as small a scale as possible.

The selection against a new company, especially by the wide-awake agents, is very real. If it becomes known that a new company is lax in any particular point, it will have loaded on it the rejects of the other companies. The new company is, therefore, well advised to keep its maximum low, to be severe in its selection the first year, and to be especially on guard against large cases.

This, however, is merely postponing the question. What rule should guide a company thereafter in retaining or re-insuring risks?

A company managed with skill, experience, and vigilance can afford to take a greater risk than one less favored. Reinsurance does not pay the ceding office. It will usually be found that over a period of years the cost of reinsurance has been double the benefits received. Another important matter is the restriction imposed on the agents as to the size of the policy.

The first consideration being safety, we enquire: What is the size of the surplus and is it increasing or decreasing? As quoted by Mr. Nichols (*T. A. S. A.*, VIII, 3), "the best test of a proper limit is the strain liable to be put upon the surplus by fluctuations."

This question has been discussed at some length. There are sev-

eral mathematical demonstrations of value and interest in the *Transactions*. They are, however, based on the assumption that (II, 66) "the lives under observation are of normal character, and that the conditions are such that the law of mortality deduced from the table may reasonably be expected to obtain among them." In life insurance these conditions do not hold and the fluctuations experienced in number and amount exceed these indicated in the formulae.

With the view of getting some idea of the fluctuations actually experienced, the record of percentage of actual to expected claims was taken from a well-known volume. Thirty companies were first taken, at random, ranging from thirty millions of business up to the largest. These were arranged in six groups of five companies each, according to their respective volumes of business. The data are, in many respects, inadequate and incomplete and some care must be exercised in drawing conclusions from them. An addition was made to the table by selecting fourteen average companies of less than thirty millions each, forming a seventh group. The following table gives a summary of the figures:

Group No.	Average.					(5)—(6) ÷ 2 = Average Fluct'n.	Fluctuation.		(4)+(9).
	Of 8 Years.	Influenza Year.	Of 7 Years.	Highest.	Lowest.		Lowest.	Highest.	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1...	70.7	91.4	67.8	73.6	62.1	5.7	3.9	8.8	76.6
2...	65.8	93.3	61.8	69.2	55.3	7.0	6.1	8.2	70.0
3...	66.4	101.8	61.3	70.5	52.7	8.9	4.2	12.8	74.1
4...	62.5	103.6	56.6	66.9	48.5	9.2	6.3	15.2	71.8
5...	67.3	100.2	62.7	73.3	51.4	10.9	3.1	18.2	80.9
6...	60.0	108.5	53.1	65.4	40.6	12.4	7.9	18.4	71.5
7...	55.7	98.2	41.7	53.8	32.2	10.8	7.1	31.5	73.2

The figures represent in every case a percentage of the expected mortality by the American Experience Table. The first column gives the group number, there being five companies of approximately the same size in each group 1–6. Only normal companies were taken. The second column gives the total of the actual to expected mortality of each of the five companies for 8 years, divided by 40. The fourth column gives the figures for 7 years (excluding 1918, given in col. (3)) divided by 35. To obtain col. (5) the highest percentage of each company in the seven years was taken and their sum divided by 5. Col. (6) was obtained similarly

from the lowest percentage. Col. (7) is the difference between cols. (5) and (6) divided by 2, to give the mean fluctuation. Col. (8) shows the smallest difference of any one company in the group between the highest and lowest fluctuation divided by 2. Col. (9) similarly shows highest difference.

The results are just about what one would have expected from such an enquiry. Group 5 is somewhat affected by the presence of one abnormal company.

Taking the results in the six groups as they stand we find for the 7 years:

(1) The average fluctuation rises steadily from 5.7 in the largest companies to 12.4 per cent. in the smallest;
(2) The increase in fluctuation is about the same in cols. (8) and (9);
(3) The smallest fluctuation occurs in one of the smallest companies;
(4) The range of the lowest fluctuation (3.9 to 7.9 per cent.) is less than the range from the lowest to the highest in group 1 (3.9 to 8.8 per cent.);
(5) Adding the highest fluctuation (col. (9)) to the 7 years' average (col. (4)), and omitting group 5 we get a range of 70.0 to 76.6 per cent. as the maximum of the 7 years.

A different selection of companies over a different period of years will, of course, give different results. Taking the companies in these seven years as being fairly normal, we would deduce from the above table the following conclusions:

(1) That the smaller companies must expect larger normal fluctuations than the larger companies;
(2) That as a company grows in size the normal fluctuations will tend to decrease;
(3) That comparing a company of fifty millions of business with one forty times its size, the fluctuation percentage (as here defined) of the former is slightly over twice that of the latter;
(4) That the smaller the percentage of the experienced mortality the larger must be the reserve to cover normal fluctuations;
(5) That fluctuations can, in some measure, be controlled by efficient management;

(6) That an average company of small or moderate size which provides for a maximum mortality of 75 per cent. of the expected by the American Table is fairly protected against normal mortality fluctuations.

In the foregoing discussion only normal fluctuations are considered. The excessive mortality of the year 1918, due to influenza, was not normal, and may be expected to recur, if not from this cause, from war, panics, or some other grave disturbance, say, once in every generation. That these disturbances will occur is certain, and they ought to be provided for. Assuming that, as we have just suffered from this burden, we shall have a long period in which to provide for its recurrence a sum of, say, 1 per cent. of the expected mortality, should be set aside each year until at least 25 per cent. additional was accumulated. The average company would then have protection against an extraordinary strain up to 100 per cent. of the expected mortality. If such a Mortality Fluctuation Fund cannot be set up at once it can thus be gradually accumulated in the next generation.

These provisions do not constitute full safety. Here also each company must work out its own solution. Some of the companies included in the above table had a mortality far in excess of 100 per cent. in 1918. But no company can consider itself safe wanting these provisions. It should be remembered, however, that natural growth should change the class of a company to one subject to smaller fluctuations and in so far as growth takes place even abnormal fluctuations lose some of their effect as can be seen by a study of col. (3).

From fluctuations we pass to the question of maximum limit of risk. The above figures give the situation as the companies now are. What effect, if any, would result from a general increase in limit?

The problem of the small company is not the same as that of its mighty competitor. The latter has to consider a few exceptional cases. The small company enquires: Our present limit is $5,000; can we safely increase it to $10,000?

Consideration of the figures of group 7 in the table does not suggest any modification of the conclusions given above.

As a company grows, the number of larger amounts applied for increases, and it is usually the growing reinsurance account which

provokes the question. The fluctuations of normal years having been considered, we have to face the increase which might arise from the additional $5,000 on each of the larger policies. If the company has been reinsuring the excess, the following has been approximately its experience, assuming an average age of 40 at entry:

Year.	Amer. Exp.	AM Exp.	Excess.
1.....	9.79	3.71	6.08
3.....	10.25	5.70	4.55
5.....	10.83	6.90	3.93
6.....	11.16	7.94	3.22
11.....	13.78	11.58	2.20
16.....	18.57	17.47	1.10

Even a first year's commission of liberal amount leaves the odds heavily in favor of the reinsuring office. To overcome this difficulty two courses are open: it may retain a larger amount at risk, or it may exchange reinsurances with another office. It may, of course, do both.

In this connection the higher mortality of the larger policies is important, and the chapter in the second volume of the American-Canadian Mortality Investigation 1919 should be carefully studied. What is true of the $50,000 and $100,000 cases in the larger companies may be true of smaller amounts offered to smaller companies. But the point has force in the case of companies exchanging reinsurances. A small company exchanging with a company five times its size is offering $10,000 reinsurance out of a $20,000 case and is receiving in return $10,000 out of a $100,000 application. It may readily trace the effects on its mortality.

That experience in the handling of large cases will lessen the mortality of such cases is undoubted, but it is also important to notice that it is the total insurance just obtained added to all now being applied for which indicates the measure of the selection against the company.

It has already been said that the additional margin of security called for is to cover excess losses of $5,000 each. If we assume that the company is receiving at least twenty permanent cases per annum, so that at the end of five years it has 100 such cases on its books, we may readily assume that the maximum strain on its surplus in any one of these years would be three cases or $15,000 in

all. If, therefore, it has, in addition to the provision for 75 per cent. of its expected mortality, an additional margin of not less than $15,000, and if its surplus is steadily increasing, it can with safety raise its limit $5,000.

Such a heavy strain as three losses in one year would soon be replaced in the mortality fluctuation fund, such replacement being made in addition to the annual increase of 1 per cent. per annum. If it be objected that these three losses might happen in the one year when another epidemic fell, it can only be replied that, in the 1918 epidemic, losses varied from about 78 to 140 per cent. of the expected mortality, and no one can foretell the pressure of the strain which may be imposed in future, or the year in which it may fall. What is here suggested is that provision be made for heavy losses in large policies in the same year as maximum normal fluctuations, before the maximum limit of retention is raised. The one thing to do is steadily to increase the surplus until at least 100 per cent. of the mortality can be cared for, and prudence will suggest more. But having such a reserve, it ought to be utilized to cover the needs of the business from time to time, without encroaching on its permanent amount.

Probably the average small company will be content to raise its limit not more than $5,000 at a time, and wait a few years before contemplating another raise, but the number of cases reinsured each year, and the margin of available surplus, must furnish a guide.

The word "surplus" as used above involves a different interpretation in participating and non-participating companies. In the former it means the whole margin of unassigned funds including the succeeding year's policyholders' dividends. If a limit is to be placed on the encroachment on the dividends, say, 20 per cent., then the surplus would be the unassigned funds plus 20 per cent. of the next dividend. In the case of a non-participating company the surplus would be the unassigned funds at the end of the year, including a normal year's increase.

Mortality and Interest Gains.

The average officer of a young company does not analyze the mortality, using the amount expected as the balancing item in the gain and loss exhibit. In this way valuable information is lost.

For the benefit of those not used to analyzing sources of profit the following table is given, showing the mortality and interest

gains on a 20 Payment Life Policy of $1,000 effected at age 35, assuming the AM mortality and 5 per cent. net interest, the reserve basis being American 3½ per cent. full preliminary term:

Policy Year.	Mortality Gains.	Interest Gains.	Total Gains.	Policy Year.	Mortality Gains.	Interest Gains.	Total Gains.
1...	$5.79	$0.00	$5.79	11	$2.42	$3.74	$6.16
2...	4.70	.32	5.02	12	2.19	4.19	6.38
3...	4.46	.64	5.10	13	1.94	4.66	6.60
4...	4.31	.98	5.29	14	1.72	5.15	6.87
5...	3.97	1.33	5.30	15	1.50	5.66	7.16
6...	3.50	1.70	5.20	16	1.29	6.18	7.47
7...	3.32	2.08	5.40	17	1.10	6.73	7.83
8...	3.10	2.47	5.57	18	.91	7.29	8.20
9...	2.89	2.88	5.77	19	.75	7.88	8.63
10...	2.66	3.30	5.96	20	.57	8.49	9.06
				25	.09	9.40	9.49
				30	—.16	10.32	10.16
				35	.03	11.20	11.23

These figures indicate the importance of mortality gains to a new company, as such gains are required to meet heavy initial expenses, including the agent's commission. As the company grows older, however, if the interest yield can with safety be maintained at not less than 5 per cent., the savings from interest tend to become a more important factor in the success of the company. In the ninth year the mortality and interest gains are each 10 per cent. of the net premium, and from this point the interest gains increase more rapidly than the mortality gains decrease. As the proportion of old to new business increases, the importance of the mortality rates tends, under the given conditions, to decrease, and the company should therefore strive to secure quickly as large a volume of business as possible even at the expense of part of its surplus.

It must, however, be kept in mind that the larger the sum the company has to invest each year the greater is the tendency to a fall in the average interest yield, and hence the greater temptation to invest in lower grade securities.

The average small company officer at the present time is probably buying bonds, as the safest, most stable, and most remunerative investment. Real estate mortgages are unsafe at present prices, without a margin too large to be practicable. But in normal times the reverse is true. It cannot be too often repeated that the funds of a life insurance company are trust funds and that in their investment no chances should be taken.

The margins of safety discussed above deal with mortality fluctuations only. Some additional margin should be provided for fluctuations in value and losses of assets. Where these are mainly short term real estate mortgages their value does not fluctuate much provided the value of the security is not seriously impaired. Some losses in assets are probable from time to time and it must always be remembered that the conditions which produce an abnormal mortality experience are likely at the same time to affect seriously the value of assets especially those subject to market fluctuations.

It must also be remembered that losses in assets affect a small company more than a large one, and that the proportion of surplus set aside to cover this contingency must therefore be relatively larger.

There are some other problems depending on the size of the company for their solution. A good instance of these is the War Clause.

War Clause.

The practice in modern war is to regiment the men of the same district together. The result is that frequently the men of a whole city or district are lost at one time. This does not seriously affect a large company carrying the risk at an extra premium, but it might easily be fatal to a company operating only in one state. The small company, therefore, must reduce its risk rather than charge an extra premium.

Management.

Under modern competitive conditions the success or failure of a small company lies in the hands of its officers at the Home Office. Given adequate capital to begin with, the requisites for success with a new company are:

(1) Proper technical and professional advice,
(2) Common business sense, resulting in efficiency and economy,
(3) Honesty,
(4) Driving power and initiative.

Experience will be gained at not too great a price as the business grows. Mistakes are inevitable but the recuperative power of a young life insurance company is something to be wondered at.

Gain and Loss Exhibit.

To enable the management to function the Gain and Loss Exhibit should be carefully drawn up. A few comments on this subject may be useful.

It has already been pointed out that the actuarial elements in the exhibit, if each could be exactly calculated, would, with the reserves of the current and previous year, give an exactly balanced statement. What may not be so generally known is that once the actuarial items are balanced the whole exhibit must balance, otherwise errors have been made in transferring the figures to the exhibit. In other words, item 105 of the exhibit, "Balance Unaccounted for" must represent only the adjustment necessary to balance the actuarial items.

The easiest way of compiling the exhibit is first to adjust and balance these items and then bring into account the Income and Disbursements, and the following items of the two years: Non-Ledger Assets, Non-Admitted Assets, Liabilities (except reserve) and Surplus, thus:

Loss.	
Last year's reserve	$
Net premiums	
Interest to maintain reserve	
	$

Gain.	
This year's reserve	$
Expected mortality	
Endowments matured	
Terminal reserves for surrenders	
Terminal reserves on lapses, less initial reserves on paid-up and extended insurance policies, etc.	
	$

If after proper and reasonable adjustments these items do not balance, Item 105, "Balances Unaccounted for," is introduced to balance them.

The first items on each side—Reserve for this year and for last year—are then dropped. The total income for the year is then carefully analyzed as required by the Exhibit, and the total of the analysis is balanced with item 45 of the Income Account. These analyzed income items are then added to the Gains. Similarly the disbursements are analyzed, balanced with Disbursement item 49 and carried to the Losses.

The items of the two years, Non-Ledger and Non-Admitted Assets, Other Liabilities and Surplus, or their differences as the Ex-

hibit may require, are then carried out to the proper side of the Exhibit.

Certain items balance out. The actuarial item "Endowments matured" balances out with Disbursement item 2 (*a*). Any sum of borrowed money shown in Income balances out with the Liability item and so on.

If this work is accurately done the exhibit balances exactly. It can then be used with confidence as a guide to management policy.

Abstract of Discussion of Foregoing Paper.

MR. ARTHUR WATT:

Mr. Halliday's paper deals with some of the problems of younger life insurance companies which would be brought to the attention of the actuary or consulting actuary. I assume that the title of the paper should have been "On Some of the Problems of the Younger Life Insurance Companies," as the discussion appears to be confined to the problems of younger companies and not to the problems of older companies which have grown conservatively. Most of the problems of younger life insurance companies, however, are concerned with getting an agency organization together and getting business at reasonable cost.

The actuary's job in the young companies, if he confines himself to purely actuarial problems, is simple, and in the majority of cases the actuary performs many other necessary functions, obtaining thereby a well-rounded grasp of the business of life insurance. The young actuary starting out as actuary of a young life insurance company, if he is alive to the possibilities of his job, should develop into one of the most valuable executives in a life insurance company. It seems to me that the possibilities mentioned have been understood by many of our younger actuaries, and the outlook for the future conduct of the business is bright. If a young actuary desires to develop his own ideas and create a life insurance company policy which will be an ornament to him later in life, I commend the possibilities in a young life insurance company. In a young life insurance company, there is scope for development of his own personality and the building of the business along sound lines. All things considered, to a young man of spirit and good education, the younger life insurance company offers inducements not found in the bigger and older companies. It is well to recognize, however, that the young actuary must be prepared to take a hand in field as well as Home Office problems, and he must be dogmatic to a certain

extent, adjusting his theories, however, to fit conditions. The most serious problems are outside of the Home Office and are centered around the big problem of competition.

Mr. Halliday has based his argument on the history of a life insurance company writing three millions of new business each year, including the first year. I think it would have been nearer the probable actual experience of new life insurance companies to have taken a very much smaller amount in the first year of operation, but increasing in amount each year. The actual experience would probably be nearer five hundred thousand dollars for the first year, eight hundred thousand dollars for the second year, a million and a half for the third year, and thereafter a volume increasing roughly by 20 percent each year. I think the rate of termination is too high in the first year for practical purposes and scarcely high enough in the second and third years. Eighty percent of first-year premiums is high for the agency expenses, and if the cost of medical examinations and inspections is added the total cost is approximately 90 percent of the first-year premiums. I do not believe that any life insurance company needs to spend that much in getting business, and contracts arranged on that basis show lack of prudence on the part of the management and especially lack of salesmanship on the part of the agency superintendent. A larger percentage than 5 percent should be charged to renewals and less than 90 percent to first-year expense. My suggestion would be not over 75 percent first-year expense, including medical and inspection, and renewal expense not exceeding 10 percent for the first nine renewal years. Where the first-year commission is as high as 80 percent one can readily understand the reason for a heavy rate of termination at the end of the first policy year. If the rate of first-year commission is too high, an undesirable type of agent is attracted. It is especially desirable that young companies should avoid "high-pressure" salesmen. The experience with such is usually embarassing and sometimes fatal. The business must be built up soundly even if slowly. The allowance for Home Office expenses seems to be entirely inadequate after the first two years. For example, in the tenth year the Home Office expenses provided for are but $2.50 per thousand insurance in force. There is scarcely a company in the United States with as much as twenty millions of business in force whose expenses of management do not amount to considerably more than this amount, the average being nearer $5.00 per thousand. It is my opinion that there should be sufficient allowance for Home Office expenses to provide for adequate service to policy-holders, including the granting of loans and the reinstatement of lapsed policies.

In the comparison of reserves, capital and surplus, four bases of valuation are employed. A pertinent comment in connection with all four is the apparent lack of provision for compensation to stock-

holders. It is assumed that business men have paid in one hundred thousand dollars capital and one hundred thousand dollars surplus on the assumption that it would be a good investment. No provision appears to have been made for dividends during the first ten years, and I doubt that many stockholders would be willing to wait that long for a return on their investment. It seems clear that if the company is prudently managed, the first-year expense will be much less and a provision will be made for some kind of return to stockholders. It seems clear also, that the Illinois Standard is the most expedient basis of valuation for a young company.

Mr. Halliday says truly that mortality, interest and field expenses vary considerably in different parts of the country and that each company presents a separate problem for study by the actuary and no general rule can be laid down for general application.

In the beginning of his paper, Mr. Halliday says that only a small amount of business can be written on a non-participating basis. He does not, however, discuss the possibilities of writing annual dividend business. He may have had this in mind as something to be recommended, and in my opinion it is of considerable importance that participating insurance should be written because of the larger premium income. Here again, however, it is necessary to keep down first-year expense to the minimum, and some kind of dividend to policyholders should be paid beginning with the second policy year as evidence of good faith on the part of the company and as an earnest of future dividend-earning capacity. It seems to me that if the business is selected carefully, and in most young companies that is done, 75 percent of the expected by the American table is a much heavier mortality than need be provided for. My opinion is that if even reasonable care is taken in the selection of business 50 percent of the expected by the American table is sufficient for normal conditions during the first ten years. However, as suggested by Mr. Halliday, it is highly desirable that a mortality fluctuation fund should be established in the beginning. In this fund should be put the difference between 50 percent of the expected by the American table and the actual mortality each year, but if that difference is less than 10 percent of the expected then the addition to the mortality fluctuation fund that year should be made up to 10 percent of the expected by the American table.

In regard to the maximum limit of risk in individual cases, that is largely a matter for executive consideration, with the advice of those concerned in the selection of risks. If there is an actuary or a medical director, it is probable that five thousand dollars can be retained on individual risks from the start, the net retention being gradually increased as the business grows and experience in selecting business is gained. In general, there is difficulty with the agency organization unless fairly large risks will be considered and the excess reinsured. Reinsurance facilities are

so good nowadays that it is practically impossible to avoid handling larger-sized cases so as to satisfy the company's agents. It is interesting to note, however, Mr. Halliday's argument for increasing the net retention as rapidly as possible so as to save some of the profit on reinsured business. As Mr. Halliday says, most of the profit in the early years is earned from favorable mortality, and it is not until the company is upwards of ten years of age that the interest earnings are any considerable item. Even for the first twenty years the mortality profit may be the most important factor as regards surplus, especially if the company values on the Preliminary Term basis and does not hold an additional reserve of considerable amount for mortality fluctuation.

In my experience, the serious problems of a young life insurance company are the following:

1. Lack of atmosphere. By that I mean lack of traditions and knowledge of life insurance practice. These are an integral part of a big life insurance company, and their lack provides the most serious handicap confronting the young actuary on taking up his work with a young life insurance company.

2. Hostility of competitors and prejudice of the public. The fierce limelight that plays upon a young life insurance company makes it a good target for the sneers and unfavorable comment of the representatives of the older companies. In life insurance matters, the public appear to be very sensitive, and the lightest word of unfavorable comment is sometimes very serious, locally.

3. A young company is a mark for bad risks. These are frequently easy to write, and the inexperienced agent unwittingly sends in to the Home Office the derelicts of the life insurance business. If the Home Office is cautious, not many of these bad risks get by, but usually the young company has not access to the impairment records of the bigger companies.

4. As a rule the quality of agents available is not first-class. They are not as well trained, nor on the average are they of as good character, and a very stringent weeding out process is most necessary if an agency organization of satisfactory character is to be built up. This difficulty is frequently increased by the necessity of paying larger commissions than are paid by the older companies. The high rate of commission occasionally attracts a good man, but more frequently attracts men of very questionable character. It is therefore highly essential that the first-year commission scale should be kept down as near to that paid by the old-established, conservative companies as possible.

5. Of somewhat minor importance is the rate of growth. In general, that is not a serious problem in the early years, as it is bound up with the twofold question of mortality and first-year expense. This point is well brought out in Mr. Halliday's paper.

MR. GEORGE GRAHAM:

The data used by Mr. Halliday in computing his tables of reserves, capital and surplus and total funds make an admirable basis for the purposes he had in mind but one who is not experienced in the difficulties that beset all new companies in their early careers may be inclined to take Mr. Halliday's figures more literally than he intends.

Fortunate indeed would be the new company whose record during the first ten years would approximate to the figures submitted by Mr. Halliday and it may not be out of place to mention some of the pitfalls which are likely to strew the way during these early years.

Liberal as the rate of termination may seem to those connected with well-established companies of substantial growth, a higher rate of withdrawal in the years following organization may be looked for. It has been observed that the rate of termination is influenced to an appreciable extent by the age and size of the company. The compensation paid to the agent and the latitude allowed him in settling for his business are also factors of some weight. If the agent be allowed an excessive commission rate or is not held to a strict accounting for all his business within the period allowed in his contract, which is usually sixty days, he will be disposed to give his policyholders too long credit in settlement of the first premium thereby jeopardizing the payment of the first renewal or he will be tempted to take chances in collecting from men of uncertain financial responsibility who are extremely unlikely to renew. A higher termination rate than that assumed will, of course, defer the time when the company will reach the turning point where loss in surplus will cease.

For first year agency expense 80 per cent. seems rather conservative; it will require more than ordinary skill to hold the acquisition expenses to this percentage in the early years of the company's career. It will mean that there must be no advances nor charging of net premiums to the agents which are not promptly repaid. Compensation to the agent should be on a straight commission basis; allowances for rent or traveling expenses or salary, no matter how modest, in addition to commissions must have no place in the agent's contract, but if exceptions should be made eternal vigilance must be exercised to eliminate these fixed charges immediately production falls below the amount on which such compensation is predicated.

It is assumed that there will be a constant amount of new business produced each year but it will undoubtedly be the endeavor of a commendably enterprising agency department to produce a steadily increasing volume year by year and the efficiency of the production department can be measured somewhat by the extent the acquisition expense rate is reduced as the volume of new business is increased. If the volume of new business remains constant year after year it

will probably be found that the agency organization is not in a healthy condition; agencies cannot be developing and the field representatives are not likely to be making money for themselves.

While the amount of business produced during the first year will depend greatly upon the cost the company cares to assume, and the greater the volume it aspires to during that first year the greater is the cost likely to be, nevertheless with each succeeding year it should be possible to increase the volume of new business and at the same time effect a reduction in the cost of acquisition as compared with the previous year. If the increase in the business is accomplished with a reduction in cost it is unlikely that in normal times more business will be produced than can be readily assimilated.

My observation has been that the real test of the efficiency of the agency department is likely to come after the first year and after the initial enthusiasm and interest of those behind the organization have been spent. These influences should not be underestimated, however, as they may be the means of placing a substantial amount of desirable insurance on the books, which will have a low lapse rate, and at greatly reduced cost, thereby permitting a very favorable showing as to acquisition expense but which will not be indicative of the future experience of the company in these respects.

The new company is a shining mark for that class of agent which fortunately is all the time growing smaller and which is referred to in really complimentary terms as "floaters." Dealings with this class will inevitably be expensive. A safe rule is to investigate every agent and require him to give a satisfactory bond.

Brokerage business can be handled on a profitable basis by companies which are thoroughly equipped but the kind of brokerage business likely to be offered to a new company will surely prove unsatisfactory. The rules governing the selection and appointment of Medical Examiners should conform to the best practice among established companies and departures from these rules should not be countenanced.

It is suggested that at the end of ten years a company which started out on the Illinois Standard can quite easily change over to the Modified Preliminary Term basis for its existing business and later on could raise its reserve basis still higher.

It is generally conceded today that the Illinois Standard is an adequate reserve basis for either a new or an established company. The author of the paper has demonstrated the advantages of using it during the first ten years in a company producing a constant volume of new business. Its superiority over the Straight Modified and the Select and Ultimate would be even more evident had it been assumed that an increasing volume of new business would be produced, an assumption more likely to conform to the actual conditions. It is difficult to see what good purpose would be accomplished by changing to a more severe standard.

The capital and surplus at the end of ten years will amount to $329,000 if the Illinois Standard be used and $229,000 if the Modified Preliminary Term standard be used. A change in the reserve basis for the existing business from the Illinois to the Straight Modified would require a transfer from surplus to reserve of $100,000 and the management would be left with a gain in surplus of $29,000 to show the stockholders as actual cash earnings for the first ten years of the company's development.

Stockholders of new insurance companies are amazingly patient but it is hard to believe that after waiting ten years without receiving any return on their investment they would acquiesce in such a proposition, nor does it seem reasonable that the management of the company should ask for such further sacrifice on their part.

Regarding the maximum retention on a single life, it is suggested that $2,500 is a safe amount for the first year if the management is inexperienced. Such an amount should certainly be safe enough even for a company in the hands of the most inexperienced officers. Is it essential in the early years of the company's existence that it be completely protected against adverse temporary fluctuations at the cost of an assured loss of the expected mortality profit on the business reinsured which might have been carried by the company itself?

Because of the use of reinsurance premiums based on the American Experience Table, reinsured business, as stated in the paper, will undoubtedly represent a loss to the ceding company over a period of years; therefore, it seems to behoove the ceding company to hold this loss to a minimum and be not too ready to transfer to another company a portion of the mortality profit which can normally be counted upon, merely to protect the surplus, which will show a shrinkage in any event, from the possibility of some further temporary depletion.

Using the Illinois Standard figures set forth in the paper the greatest encroachment on the surplus has occurred by the end of the third year and then only to the extent of $33,000. As the original investment has not been replaced by the end of six years a temporary disturbance of the normal progress of the surplus account during that period would be of minor importance.

Difficulties enough will be encountered by the Agency Department in securing desirable representatives in the field without further burdening them with an unduly small maximum retention because when reinsurance has to be secured delays are inevitable and the cost due to the lower commission paid by the reinsuring company than is usually paid to the agent will have to be borne either by the company or by the agent. If charged to the agent he will not like it and if paid by the company it represents a further expense to it. An initial retention of $2,500 impresses me as overconservative for any management which has the intelligence in the first instance to call for expert advice.

It would be interesting and enlightening to know what were the maximum retentions of the companies showing the highest and lowest fluctuations in each group as compared with the average retention of all the companies in the group. If volume and maximum retention were the only factors having an influence on fluctuation it may be presumed, of course, that the company with the most conservative retention showed the smallest fluctuation, yet it is possible that a closer analysis might show that other influences had a bearing on the situation.

Was the high figure in column 9 for group 7 due to an excessively heavy mortality or to an abnormally light mortality in a particular year?

Should a company on increasing its retention on new issues adjust all reinsurance in force? To do so would reduce the possibilities of fluctuation and will generally be found profitable to the principal company.

A new company rarely has an opportunity immediately to contract for an exchange of reinsurance so that it is denied this compensating profit as an offset to the business it reinsures. Moreover, to exchange with a company having a much larger retention is to give itself the less attractive part of the contract because its smaller maximum policies are unlikely to reflect the heavy mortality found to apply to policies of $50,000 and $100,000 in the American-Canadian and other investigations to as great an extent as the maximum policies of the larger company.

The surplus contributed by the stockholders need not be used merely as a fund available for the expense of development of the business but at the same time can properly be considered as a reserve fund available to protect the company against adverse fluctuations in the mortality.

Not only will an increasing volume of new business help to insure to the company a continued favorable mortality experience but it will also have the advantage of enabling it more quickly to absorb the fixed charges down to a normal ratio.

Mr. Halliday mentions the War Clause. The insistence on the part of the actuary of a young company that the policy contract shall contain a war clause is a source of frequent complaint from the men in the field and often the reason is not well understood by other officers of the company who cite the practice of many of the large companies which issue policies free from such restrictions. These large and established companies may contend that only their younger policyholders will be exposed to the hazards of war and any losses sustained can without great difficulty be absorbed by the whole body of their policyholders which includes a great proportion of lives who have passed the age of exposure to this hazard. Whether or not this is correct reasoning, the young company has to face exactly the reverse condition. Its policyholders of military age are

likely to predominate and certainly the amount of business it has on the lives of those beyond military age cannot be sufficient to absorb possible war losses among its younger policyholders.

I have mentioned nothing of importance which has not been touched upon by the author. I have tried merely to emphasize some of the factors which impress me as being of rather more importance than the brief references made by the author in his paper would seem to signify. I know that they were not absent from his mind when preparing his excellent paper.

(ORAL DISCUSSION.)

MR. C. D. RUTHERFORD:

One of the principal difficulties that the management of a small company has to deal with is the question of dealing with the shareholders. At the time a management really takes charge of a company it often finds that the stock has been sold to the shareholders under the pretension that a dividend will be paid in a very few years, and generally speaking the people who sold the stock have gotten out. This in itself is a very serious problem and one best met right at the outset. Another point that has possibly been given at once too much and too little attention in discussion has been the question of reinsurance. I am inclined to agree with Mr. Halliday that a low retention is advisable, but at the same time it does not necessarily follow that reinsurance is a loss. It is quite possible as a general rule for a company to reinsure on the co-insurance plan and obtain from the reinsurance company a commission equal to or greater than what it is paying to its own agents, and the excess amount in such cases can be looked on as a payment on account of the head office expenses of the company. I think that ought to be taken into account generally speaking in dealing with the question of reinsurance.

MR. M. W. TORREY:

There is nothing much I can say as to the problems confronting a small company. Referring however to the subject of reinsurance the main point to be considered is that of satisfying and holding your agents. Another point is the question of loss through reinsurance. There is, of course, a loss, but on the other hand if you are not able to place reinsurance you could not write a large policy and would thus lose the benefit of the five or ten thousand retention which you could carry yourself.

(AUTHOR'S REVIEW OF DISCUSSION.)

MR. W. R. HALLIDAY:

The writer is quite in agreement with the comments of Mr. Graham. Of course, no new company will write three million dollars of new business each year from the first to the tenth year, and it may be assumed that the Home Office expenses will be somewhat in excess of those used in the model office. Variations in these figures however, would have but little effect on the argument in the paper, as that is concerned solely with a comparison of the results of using different reserve bases. He is also correct in his comments on the rate of termination.

Some comments have been made on the subject of dividends to stockholders. Notwithstanding promises made by stock salesmen, no new company should contemplate the payment of dividends to stockholders during the first ten years. Such dividends paid during this period are simply a mortgage on the company's future, and nothing should be left undone to educate the stockholders on this point.

Mr. Graham sees no necessity for a stronger reserve basis than the Illinois Standard, but one great argument for the adoption of a stronger reserve is to check any tendency on the part of stockholders to drain the company dry of all its resources except the minimum legal reserve. It is quite true that about $88,000 would be transferred from surplus to reserve if the basis was changed to the Modified Preliminary Term plan at the end of the tenth year, but this would leave a surplus of about $141,000, a surplus which, moreover, is increasing at the rate of $35,000 per annum. This suggested change of reserve basis therefore, would prevent neither the declaration of a stockholder's dividend at the end of the tenth year, nor annually thereafter without injury to the company. Indeed the change of basis would tend to stabilize such an annual dividend.

Mr. Graham asks whether the high figure in column 9 for group 7 was due to an excessively heavy mortality, or to an abnormally light mortality in any particular year. The figure in question was due to a very high rate of mortality in 1919. It may have been due to influenza carried over from the previous year, but its existence is a warning to the younger companies emphasizing the fact pointed out in the paper, that the lower the average rate of mortality, the greater will be the fluctuations to be encountered.

Industrial Life Insurance.

BY

J. D. BUCHANAN.

In the hope that a paper on Industrial Insurance, taking up some of the salient features of the business, would be of interest to students and other readers of the *Transactions* of the Society, this paper is being presented. The various points discussed refer chiefly to the business as carried on in the United States and Canada.

General Remarks.

As the name would signify, Industrial Insurance is conducted mainly among the industrial classes. The amount of insurance is based on a level premium payable weekly, the weekly premium usually being some multiple of 5 cents. Although there have been attempts to conduct this class of business with premiums payable monthly, such efforts do not seem to have been successful and Industrial Life Insurance might reasonably be called Weekly Premium Life Insurance. The average amount insured under each Industrial Policy has usually been small, generally not greatly in excess of the amount necessary to pay funeral expenses. Of late years, however, this average has been increasing and efforts are being made to provide a death benefit substantially in excess of the funeral expenses; indeed, some Weekly Premium Insurance is written on an income basis; that is, provision is made for an income to the beneficiary for a definite period after the death of the Insured. The business is sold mainly to those persons belonging to the wage-earning class, who, from the nature of their income, find it convenient to pay small premiums weekly but difficult or impossible to regularly meet premiums for Ordinary Insurance, where substantial amounts are required yearly, half-yearly or quarterly. The weekly premiums on Industrial Insurance are usually collected each week by a house to house visitation. A very large proportion of Industrial Insurance is written on the lives of women and children, since it is the aim quite generally to insure all the members of the

family in order to meet the strain incidental to the last illness and death of any one in the family group. In the case of children, however, the death benefit is generally limited by the statutes until the child attains the age of ten years, to prevent any tendency towards speculation on infantile lives. The amount of protection that may be afforded children would appear to be too low to be in accord with present-day conditions.

From the nature of Industrial Insurance it is evident that it can be conducted only at a much higher rate of expense than is the case with Ordinary Insurance, on account of the more extensive service rendered the Insured. The business should be carried on in a manner as devoid of complexities as possible, in order to keep expenses to the lowest point consistent with good business. A larger staff is required both at the Home Office of the Company and in the field, to take care of Industrial Insurance than would be required for the same volume of Ordinary Insurance. On account of the great amount of detailed work, it is necessary that the strictest attention be paid to efficiency in the conduct of the work in the various departments of the business.

The main features of Industrial Insurance may be summarized as follows:

1. Premiums are payable weekly,
2. Premiums are collected in the home,
3. The amount of Insurance is the variant, the premium being of even amount,
4. Protection for all members of the family is aimed at.

Brief History of Industrial Insurance.

The first industrial insurance company in England—The Industrial and General—was established in 1849. Prior to this date, however, Burial Insurance was provided by Burial Clubs and Friendly Societies. The protection afforded by these latter organizations was considered quite inadequate to the needs of the public when in 1854 the Prudential Mutual Assurance, Investment and Loan Association commenced the writing of Industrial Insurance. The name of this Company was afterwards changed to The Prudential Assurance Company and it became notably successful. At first this Company did not accept business on the lives of young children, but in a few years the business was accepted at any age

between 3 months and 60 years, and the writing of infantile insurance, an important feature of the business, was commenced. In 1865, through legislative enactment, the British Government Post Office Department commenced the writing of Industrial Insurance. The Post Office plan did not prove to be the success hoped for. Almost from the time of its establishment the Industrial Insurance business had a substantial growth in Great Britain, although the early years were not characterized by the remarkable progress that afterwards followed. The history of the growth of the Prudential of England is an interesting study in itself and impresses one with the great success of this business in Great Britain.

Undoubtedly the success of the conduct of Industrial Insurance in Great Britain had great influence on its introduction in America. In 1874 the Honorable Julius Clark, Insurance Commissioner of Massachusetts, commented on the great benefit the English Prudential was conferring on the industrial classes of Great Britain and on the need of the establishment of such a system in America. In 1875 in America, the Prudential Insurance Company of America (then the Prudential Friendly Society) issued its first Industrial Policy and in 1879 the John Hancock Mutual Life Insurance Company and the Metropolitan Life Insurance Company commenced the transaction of Industrial Insurance. Hitherto hundreds of Fraternal and Assessment Organizations had been insuring lives among the industrial classes in the United States but with unsatisfactory results, largely due to the unsound methods used in the conduct of their business.

In the early years the companies had great difficulties to contend with. The expenses incidental to establishment were heavy, the mortality was much less favorable than it afterwards became, and a lack of public confidence had to be overcome. After the passing of the experimental period, Industrial Insurance experienced a remarkable development, the increase in the business greatly exceeded the proportionate increase in the wealth of the population and the business rapidly became an important factor in the country's social progress. At the end of the year 1880 there was about 20 millions of Industrial Insurance in force; at the end of 1900 about a billion and one-half and at the end of 1920 about six and one-half billions.

If space would permit, it would be interesting to discuss in detail the development of Industrial Insurance in America. The outstanding features have been the stability of the business and the

increased liberality to policyholders. Policy contracts have become more elastic in their provisions, guaranteed values more liberal, and more liberal death and endowment benefits and bonuses have been provided, with the improved mortality and increased knowledge of the business.

There are a comparatively small number of companies in the United States doing an Industrial business; some of the more important in point of volume and territory covered are the Metropolitan, the Prudential, the John Hancock, the Western and Southern, the Life Insurance Company of Virginia, the American National and the Colonial Life of Jersey City.

Industrial Insurance was introduced in Canada in 1881. The business thereafter met with a very consistent and satisfactory growth. Almost all of the business is carried in the Metropolitan, the Prudential and the London Life. The amount of Industrial Insurance in force on December 31, 1920, was about three hundred millions.

This business was not conducted vigorously in Australia until 1887. Considering the nature of the country and the scattered population, the business has been remarkably successful in that country.

While Industrial Insurance appears to flourish best in the English speaking countries, it has been transacted with a large measure of success in Germany, Italy and other countries.

In spite of the great good that has been accomplished through Industrial Insurance, it has not been free from criticism. The main point of attack has been the high rate of expense of conducting the business. It has been argued that too large a portion of the premium receipts is used to remunerate the large staff of agents required to carry on the business. In Great Britain, a Departmental Committee investigating Industrial Insurance recently submitted a Report in which the rate of expense was one of the features of the business that was criticized. While it is generally admitted that expenses should be brought to the lowest point possible, a study of the question leads one to the conclusion that agents are indispensable in a successful Industrial business, both to secure a healthy flow of new business and to collect the weekly premiums. A British Parliamentary Committee enquiring into the slow progress made by the British Post Office Department concluded that the comparative failure was due to the absence of personal solicitors and col-

lectors. The Massachusetts Savings Banks, in their effort to conduct Industrial Insurance without a Field Force, did not have the success anticipated, although the enterprise was well supported, both by the State and employers of labor. Vigorous efforts have been made by the companies to reduce expenses and to reduce the economic loss through lapses. These efforts have had a large measure of success. The records show increased benefits and service to policyholders, and a better conservation of the business.

Field Service.

As would be expected, the Industrial Life business is mainly confined to the larger centers of industry, although it is carried on to some extent in the smaller towns. It is not extensively conducted in agricultural communities on account of the fact that there is not so much demand for it, that the incomes of the largest part of the people in such communities do not harmonize with the business, and also on account of the difficulty in collecting premiums. The business can be conducted more economically in the larger cities, since it is much cheaper to collect the premiums in a closely inhabited area. In connection with the selling of this business it is necessary for the agent to realize that for some people Industrial Insurance meets their circumstances better than Ordinary Insurance, while for others Ordinary Insurance is more suitable. If it is probable that the insured would have difficulty in paying the premiums as they fall due under Ordinary Insurance and that there would be a tendency towards a heavy lapse rate, Industrial Insurance is a better proposition. Since companies doing an Industrial business usually write Ordinary as well, the agent may sell either class of policy. Among the Industrial classes there are always individuals who become able to support Ordinary Insurance, owing to improvements in their financial position. The Industrial agents are encouraged to endeavor to write such cases on an Ordinary Plan, in order that the insured may obtain any advantage accruing from a lower net cost under Ordinary Insurance.

Although the organization of the Field Force varies with different companies, the following is a general plan under which it is believed the Field Staff of an Industrial company may successfully work.

The company's entire field territory is divided into districts. The size of the district varies with the individual company. A large city, for instance, may be divided into several districts, whereas a

medium-sized city or a number of adjacent smaller towns may constitute a district. A Superintendent is placed in charge of a district and is assisted by a number of Deputy Superintendents. The Superintendent and his Deputies are responsible for the details of the business transacted in the district and supervise the work of a staff of agents assigned to them. They are required to instruct the agents, to employ new agents and assist in the writing of new business. Regular agency meetings are held for the instruction and encouragement of agents to assist them in rendering the best service to the community. Each agent is given the work of collecting the premiums on a certain so-called debit. He is furnished with a list of all the policyholders from whom he is required to collect premiums recorded on a loose leaf folder called a Life Register. This is modified weekly to provide for the addition of Issues and Revivals and the deduction of Matured Endowments, Lapses, Death Claims, Policies becoming paid-up, Surrenders, etc. A duplicate of the Register is kept at the Home Office. The total of the premiums corresponding to the business shown on the Life Register is the Weekly Premium the agent is required to collect and is the amount debited to him, after adjustment for premiums paid in advance or in arrears. The Debit of an agent is, in reality, the total Weekly Premium he is debited with or required to collect, but is sometimes spoken of as the list of the Policyholders from whom he is required to collect the premiums. The number of policies on a Debit probably averages between seven hundred and fifty and one thousand five hundred, but the number would be lower in a scattered district and higher in certain sections of large cities. The agents are required to make the weekly collection of premiums and the Debits are so arranged that the agent can, during the week, both make one week's collection and have time for writing new business. It is important that the policyholders of a debit be concentrated insofar as is possible, to reduce to a minimum the time required to make the necessary calls.

Each policyholder has a Premium Receipt Book or Card, on which the agent is required to mark up the premiums received as he collects them. The agent carries a collection book in which it is his duty to record the amounts collected. He is held responsible for the amount collected, as shown in his Collection Book and in order to ensure that the amount reported is correct and that the policyholders and the company are being fairly treated, an inspection of

the Debit is made by a Deputy Superintendent or an Inspector, at regular intervals. In the inspection, the amount the agent reports in his Collection Book is checked with the amount shown in the premium receipt record held by the insured.

When the policyholder is four weeks in arrears in premiums the agent must report the policy for lapse. The Superintendent or Deputy Superintendent is required to interview the insured when such report is made and endeavor to keep the business in force. Vigorous efforts are made to keep down the lapse rate and to revive lapsed business. Lapses are a loss to the insured and unsatisfactory to both the company and the agent.

The remuneration of the agent comes from three sources: (1) a percentage of the premiums collected on the debit, or a salary based on the total premium of the debit, (2) commissions for new Industrial business, and (3) commissions for new Ordinary business. The commission payable for new Industrial business depends not only on the amount of new business secured but also on the lapse record. An unfavorable record as to lapses has an adverse effect on the amount of commission allowed. On account of the method of remuneration of the agent, there is a definite incentive for him to keep the business from lapsing, to save the deduction from his commissions and to maintain his salary from premium collections. The Superintendent and the Deputy Superintendent are paid a fixed salary with a bonus depending on the increase in premium in the Debits for which they are responsible. The system of compensation encourages conservation of the business, which is absolutely essential if it is to be successfully conducted. It is important that due recognition be given to the efforts of members of the Field Force to render good service and that they be advanced in position according to merit. Due to the excellent supervision of the Field Force and the care taken in selecting new members of the staff, the number of cases of fraud on the part of Industrial agents is small, a remarkable feature of the business.

During the past few years, with the increase in the incomes of wage earners and the increased appreciation of the benefits of Life Insurance, the Industrial agent has been able to write a much larger volume of Ordinary insurance than hitherto. In spite of the fact that a large volume of Ordinary insurance has been written among the Industrial classes, Industrial insurance has flourished. The average Industrial policy written has increased, new insurance has

been more easily obtained, it has been less difficult to conserve the business and it has been practical to extend the agent's Debit. These conditions have resulted in an increase in the incomes of the Industrial agents, as the cost of living rose, and have enabled the companies to maintain the morale and efficiency of the agency force and keep the expense rate within reasonable bounds during a period of inflation.

Valuation.

Office Methods.

The actual work of preparing the data and making a valuation, considering the large number of policies on the books of an Industrial company, may be carried on with comparative simplicity by a Group Valuation method. The details of the work would vary in different companies on account of varying conditions but the following is a general description of a method of conducting the work for the main body of an Industrial business. In some companies more subdivision of the work would be required than is here shown.

The Actuarial records are kept on cards. Cards for new business are written from the applications accepted each week. The records are adjusted weekly by picking out the cards for the policies the agent reports for lapse and for the policies becoming claims and inserting from the lapse file cards for revivals by use of the revival applications. Tabulations are made each week by policies and units. A unit may be taken as a 5 cents a week premium. The use of the unit rather than the actual amount of insurance in the intermediate stages of the work reduces the size of the figures to a minimum. The cards for issued policies are sorted into groups by plan and age and each group totalled. The cards for lapses, claims, and revivals are sorted by plan, year of issue and age. Mechanical sorting and tabulating machines may be used very advantageously for this work. The results of the tabulation are recorded each week on weekly tabulation sheets. These sheets are totalled and the totals are checked by means of the agency records. At the end of a month the weekly tabulation sheets for the month are combined into a monthly tabulation sheet which shows the issues, lapses, revivals, etc., in each valuation division for the month. After the monthly tabulation sheets have been checked the figures are transferred to a register containing a record of the policies and units in force for each valuation division. It also contains columns

in which may be entered each month, according to the number of policies and units, the new issues, revivals, lapses and claims in order to make the adjustments necessary to carry forward the business existing from month to month. When the existing have been obtained for each valuation division, to make the valuation it is simply necessary to transfer such data from the register to ruled valuation sheets headed according to plan and year of issue with columns for the age, number of policies, number of units, amount of insurance per unit, amount of reserve per unit, etc. Multiplying the number of units by the amount of insurance per unit and the reserve per unit, accumulating and totalling gives the insurance in force and the amount of the reserve liability.

Bases.

In Great Britain the English No. 3 and the English No. 6 Population Tables are the mortality tables chiefly used for the valuation of Industrial policies. The rate of interest largely used is 3 per cent., but rates as high as 3½ per cent. are also assumed. A prospective valuation is made; the actual basis varies with the company and is governed by the British policy of freedom and publicity. According to the Board of Trade Returns a large proportion of the Industrial business is valued by deducting from the present value of the sums assured the present value of the net or pure premiums or the present value of a percentage of the gross premiums. This percentage varies but it is not usually less than 60 per cent. of the future gross premiums or more than 70 per cent. It is not the general practice to set up a reserve on Whole Life policies on the lives of children until the child attains the age of 10. Less rigid bases than the above are in some cases used for Industrial valuations in Great Britain.

In the United States three mortality tables are mainly used in the valuation of Industrial business: the Actuaries' Table, the American Experience Table and the Standard Industrial Table. The rate of interest used in the valuation of business issued prior to 1901 is usually 4 per cent. and for business issued subsequently, 3½ per cent. The following extract from the New York Statutes relates to the valuation of Industrial Policies in New York:

> "The legal minimum standard for the valuation of industrial policies issued after the first day of January, nineteen hundred and seven, shall be the American experience table of

mortality with interest at three and one-half per centum per annum, provided that any life insurance corporation may voluntarily value its industrial policies written on the weekly premium payment plan according to the standard industrial mortality table or the substandard industrial mortality table. Any life insurance corporation may voluntarily value its policies, or any class thereof, according to the American experience table of mortality, or if industrial, at its option, according to the standard industrial mortality table or substandard industrial mortality table, at a lower rate of interest than above prescribed, but not lower than three per centum per annum, and with or without reference to the select and ultimate method of valuation, and in every such case shall report the standards used by it in making the same to the superintendent of insurance in its annual statement, provided that no such standards if adopted shall be abandoned without the consent of the superintendent of insurance first obtained in writing."

In the State of Massachusetts the valuation standard for business issued prior to January 1, 1901, is the Combined Experience Table of Mortality with interest at 4 per cent. and for business issued subsequently the American Experience Table of Mortality with interest at 3½ per cent., but the Statutes permit of the use of a higher table of mortality for Industrial business if approved by the Insurance Commissioner. For business issued within two years of the date of valuation the Insurance Commissioner may allow a deduction of seven-twelfths for the first year's issues and one-quarter for the second year's issue of the reserve ordinarily required.

In the State of New Jersey the provision governing the valuation of Ordinary business covers the valuation of Industrial business, but the Preliminary Term Insurance provision does not apply to Industrial business and the Commissioner of Banking and Insurance has power to vary the standards of interest and mortality in the case of Industrial Insurance.

In some states Preliminary Term methods of valuation are extended to Industrial policies and in some the statutes do not specifically govern the valuation of Industrial business.

In Canada the companies are allowed to employ in valuation any of the standard tables of mortality used in the construction of their tables, with interest at a rate not exceeding 3½ per cent. The Dominion Act provides that Whole Life Industrial Policies and Endowment Industrial policies maturing at age 80 or any higher age shall be valued upon the following basis, namely: Policies issued in

any calendar year shall be valued at the end of such calendar year as if then just issued and at the end of the succeeding calendar years as if in force one, two, three, or more entire years, as the case may be. In the case of policies on other plans, a deduction from the full level net premium reserve is allowed during the first four years on a basis similar to that for Ordinary insurance.

To obtain the full level net premium reserve under Industrial business the assumption is made that the policies are issued in the middle of the calendar year and on December 31st the reserve per unit for each age is taken as the mean of two terminal reserves, one at the end of the previous policy year and the other at the end of the current policy year. The calculation of the reserve on this basis has been criticized as not being closely enough in accordance with the facts during the first two years where the lapse rate is heavy. If a larger proportion of the issues in the beginning of the calendar year has lapsed off the books than of the issues in the latter part of the year, on December 31st the average date of issue of each policy in force will be later than the middle of the year with the result that the reserve is over-estimated. The above is on the assumption that issues are uniformly distributed over the year. If there is a larger proportion of the business issued in the latter part of the year than in the early part the error would be accentuated. Another point regarding the effect of lapses on the required reserve liability is that of the business issued within the two calendar years preceding the valuation, a certain proportion may be expected to permanently lapse in the succeeding calendar year, and the reserve be released.

There is a heavy strain on the company incidental to setting up the full level net premium reserve for recently issued business on account of the high initial expenses. This would vary with the basis on which agents are compensated for new business. In view of this fact and also having regard to the effect of the lapses on the reserve liability required for recently issued business a deduction from the full level net premium reserve on a conservative basis varying with the plan of policy is justified. Unless relief of this nature is granted it is practically impossible for a young company to establish an Industrial business. It is even more difficult to start an Industrial company than an Ordinary company. The operations of an Industrial company should be extended over a fairly wide area to prevent possible serious mortality fluctuations from

unfavorable local health conditions. For a time the policyholders are too scattered and the debits too small to enable the company's field force to make collections at other than an unusually high rate of expense.

Selection of Risks and Mortality.

There is less rigidity in the selection of risks for Industrial insurance than for lives applying for Ordinary insurance. Since the average amount insured under each policy is much smaller, the margin for expenses does not reasonably permit of as heavy an initial Medical or Inspection expense charge. In a large proportion of cases where the amount of insurance is below a definite minimum, no medical examination is required unless there is a statutory requirement for such. This minimum may be set at from $250 to $500; the practice of different companies varies in this connection. Where the amount of insurance applied for is below the limit set, the company may obtain an inspection by one of its representatives, other than the agent, but some companies accept the risk on satisfactory statements made by the insured and a responsible agent. In doubtful cases, of course, a medical examination or inspection would be obtained. Where the amount of insurance exceeds the company's limit for non-medical business, a short form of medical examination is required. The examination is not as thorough as the usual examination for Ordinary insurance; a lower fee is paid for it. Inquiry is made particularly into the state of health of the applicant, the history of past illnesses and the occupation, in the case of adults. The companies do not obtain as definite information with respect to habits, environment, occupation, etc., as in the case of applicants for Ordinary insurance. Applicants engaged in a great many occupations involving extra hazard are accepted for Industrial insurance who would not ordinarily be taken at standard for Ordinary insurance. In the case of border-line risks, restrictions are placed on the amount of insurance that will be accepted. Care is taken to prevent the issue of insurance to distinctly intemperate or immoral persons or those persons engaged in occupations not considered in the interests of the public welfare. Rules are adopted, also, to prevent over-insurance on certain types of risks.

A much higher mortality is expected on Industrial risks than among risks insured under Ordinary policies and higher than that of the general population. This higher mortality is largely due to

the conditions under which a large proportion of Industrial policyholders live. These include such influences as improper and unsanitary housing conditions, inadequate medical attention, unhealthy working conditions and other factors. In the early years of Industrial insurance these conditions were a great deal worse than those existing at the present time and the companies suffered from a higher mortality from ravages of epidemics, a high death rate from consumption and a high mortality among children from infectious diseases. The improvement in the mortality of Industrial risks in recent years, exclusive of the years of the influenza epidemic, has been due to a number of factors. There has been an improvement in the mortality of the general population due to public health work and that of private organizations, better medical service, more satisfactory housing conditions, increased knowledge on the part of the public of the prevention of diseases and through improved conditions in industrial establishments both with respect to the health of the worker and prevention of accidents. The mortality under Industrial policies after two years has been observed to improve as the duration of the policies increases, for the same attained ages. This may indicate a selection against the company on the part of those applying for new insurance, particularly if there is a selection against the company on the part of those who find difficulty in paying premiums. On the other hand, it may indicate that although certain policyholders in bad health are not as likely to lapse their policies as those in good physical condition, a higher type of individual would tend to keep up the insurance, while the shiftless would tend to allow their policies to lapse, with the result that the mortality experience as a whole would show improvement.

While the mortality of an Industrial company depends to a large extent on the methods employed in the selection of risks, there are a number of other important factors. The character and loyalty of the Field Force, in view of the responsibilities placed on them in the selection of risks, would have an important influence on the mortality. The experience depends to some extent on the territory covered, since the public health and mortality in some sections are better than in others. The distribution of business by districts is, therefore, an important factor in the mortality of the company. A company confining its business mainly to large centers would not usually be expected to experience quite as favorable mortality as a company which had a much larger proportion of policyholders resi-

dent in smaller centers. Since the experience on women risks, particularly single women risks, has been so favorable, the proportion of the business insured on women has an important effect. This proportion, from the fact that Industrial insurance is largely family insurance, is not likely to vary greatly, with companies transacting business over the same area. The mortality is less favorable among colored risks, Chinese residents in America and Indians than among whites. The proportion of such risks in the business of the company has an influence on the mortality. The mortality also varies with the plan of insurance. An Industrial company which encourages business on Endowment plans would tend to have a lower mortality than a company with a substantially larger proportion of business on Life plans.

Determination of Amount of Insurance Corresponding to a Unit Weekly Premium.

In the calculation of the amount of insurance corresponding to a unit premium, as in the calculation of premiums under Ordinary insurance, three factors are involved, those of mortality, expense and interest.

Particular attention must be paid to the proper loading for expenses. The expense of conducting the business is high, largely through the high cost of collecting premiums by house-to-house calls and careful consideration must be given to the possible future trend of expenses. The major portion of the expenses is a percentage of the gross premium since Collection Expenses, Commissions and Taxes are a percentage of the premium and charging expenses as a percentage of the premiums gives satisfactory practical results.

In connection with mortality, the company's policy in the selection of risks must be considered and a mortality table that will meet the experience on Industrial risks must be used. Most companies of a reasonable size may obtain a fairly satisfactory Industrial experience of their own. In the past both population tables and tables based on the experience under Ordinary business have been used, in many instances, as a basis for premium rates. Probably the most reliable published table is the Standard Industrial table which is used extensively in America. Reasonably selected business should show a mortality well below the expected by this table.

Practically the same considerations apply to Industrial business

that hold in the case of Ordinary business with respect to the determination of the interest rate.

The amount of insurance granted for premiums higher than the unit premium is usually in direct proportion to the amount corresponding to the unit premium. The age is taken as age next birthday.

Formulae for Calculations.

Let Unit Premium = 5 cents per week.

If, from an analysis of the cost of conducting the business, it is decided to charge for expenses and contingencies K per cent. of the premium, obviously the net annual premium in the case of a 5-cents-a-week policy would be (\$2.60) $(100 - K)/100$, where the year is assumed to be 52 weeks.

The amount of insurance for a 5-cents-a-week policy, if denoted as \$ S, may be determined roughly by the following formulae for age x at issue:

Whole Life Policy,

$$S = \frac{100 - K}{100} \frac{(2.60)}{P_x},$$

n-Year Endowment Policy,

$$S = \frac{100 - K}{100} \frac{(2.60)}{P_{x\overline{n}|}},$$

n-Payment Life Policy,

$$S = \frac{100 - K}{100} \frac{(2.60)}{{}_nP_x}.$$

The above formulae assume that the total year's premium is paid at the beginning of the policy year and that claims are paid at the end of the year of death. In practice claims are, on the average, paid almost immediately at death and the weekly premiums are premiums in themselves with no deduction for instalments of premiums falling due in the remainder of the policy year of death. Taking account of these factors the amount of insurance for a unit premium may be more accurately determined by the use of continuous functions as in the following formulae:

Whole Life Policy,

$$S = \frac{100 - K}{100} \frac{(2.60)}{{}^{(\infty)}\overline{P}_x},$$

n-Year Endowment Policy,

$$S = \frac{100 - K}{100} \frac{(2.60)}{{}^{(\infty)}\bar{P}_{x\overline{n}|}},$$

n-Payment Life Policy,

$$S = \frac{100 - K}{100} \frac{(2.60)}{{}^{(\infty)}_{n}\bar{P}_{x}}.$$

The above formulae assume a uniform expense charge throughout the duration of the policy. If it be assumed that the expenses and the amount necessary to carry the risk absorb the premiums for the first year of the policy, and that the expense charge in subsequent years be K' per cent. of the premium the following formulae would apply:

Whole Life Policy,

$$S = \frac{100 - K'}{100} \frac{(2.60)}{{}^{(\infty)}\bar{P}_{x+1}},$$

n-Year Endowment Policy,

$$S = \frac{100 - K'}{100} \frac{(2.60)}{{}^{(\infty)}\bar{P}_{x+1\overline{n-1}|}},$$

n-Payment Life Policy,

$$S = \frac{100 - K'}{100} \frac{(2.60)}{{}^{(\infty)}_{n-1}\bar{P}_{x+1}}.$$

The use of 52 weeks rather than $52\frac{5}{28}$ weeks, the more correct figure in the above formulae, introduces a very small error on the side of safety.

For infantile policies more detailed calculations are, of course, required to provide for the varying amounts of insurance in the early years of the policy.

On account of the greater liability of an Industrial policy to lapse by reason of the frequency of premium payments and of other factors, Industrial companies expect a higher lapse rate on Industrial insurance than under Ordinary. It has been argued that the lapse factor should be introduced in the calculation of the amount of insurance corresponding to a unit weekly premium. There are a number of reasons why such a factor should not be introduced under present day conditions:

(1) The rate of lapse is an uncertain quantity and a reduction in the lapse rate in the years to come is probable;
(2) A large proportion of lapses, particularly those occurring soon after the issue of the policy, are a loss to the company;
(3) Liberal non-forfeiture values are usually granted after the end of the third year;
(4) Where the lapse rate is high some selection against the company may be expected.

The Policy Contract.

It is desirable that the policy be simply worded and drawn up in such form as to be readily understood by the policyholder. Consistent with the best interests of the policyholder, the provisions of the policy should be such that the routine work may be kept to a minimum in carrying out the policy's terms. The plans of insurance should be straightforward and simple and the number of plans issued by the company should be limited so that the Industrial agents may become thoroughly familiar with the terms of the various policies issued by the company and also in order that the number of subdivisions of the business may be kept as low as is practicable.

The Industrial policy usually contains a schedule setting out distinctly the policy number, the date of the policy, the name of the insured, the age next birthday, the weekly premium and the amount of insurance.

Many of the provisions of Industrial policies issued in the United States and Canada are similar to those usually contained in Ordinary policies. The following headings refer either to provisions not contained in policies for Ordinary insurance or to features of the contract of particular interest.

1. *Payment of Premiums.*

The weekly premiums are payable at the Home Office of the company or to an authorized representative of the company. The policy usually provides that if the premiums are not called for it shall be the duty of the policyholder to make payment direct to the Head Office or District Office. While nearly all premiums are collected by personal calls of the agent, circumstances arise, such as change of address of policyholders, which make it impossible for a com-

pany's representative to make the collection within the usual grace period of four weeks.

2. *Allowance for Direct Payment of Premiums.*

Some policies allow policyholders making payments direct to Head Office or to the District Office, a return of 10 per cent. of the premiums so paid at periodical intervals. Certain restrictions are placed on the amount of the allowance granted if the policy is allowed to lapse, although afterwards revived, to encourage persistency.

3. *Return of Premium.*

Most policies give the policyholder the right to surrender the policy within two weeks from the date of issue, if dissatisfied with the policy, and in such case the premiums paid would be refunded.

4. *Facility of Payment Clause.*

Under this clause the company has the right to make payment of the proceeds of a policy to any relative by blood or connection by marriage, or to any other person who, in the opinion of the company, is entitled to the proceeds on account of having incurred expense on behalf of the insured or for his or her burial.

5. *Death Benefit in First Six Months.*

In the event of the insured's death within six months from the date of issue of the policy, the amount payable is usually limited to one-half the amount of the policy. In most policies exception is made in case of death by accident and the full amount of the policy is allowed in such case.

6. *Limitation of Insurance.*

If, at the date of issue of the policy, the life is insured under another Industrial policy issued by the same company, the policy shall be void unless endorsed permitting the policy to be in force concurrently with such other policy. It is impracticable to keep a name index of Industrial policyholders and it is necessary that the company have a restriction of this character to keep the insurance within the limits the company is prepared to take.

7. *Table for Infantile Policies.*

The amount of insurance is limited by the statutes and a table is placed in children's Industrial policies showing the amount of death benefit for each year until age ten is reached.

8. *Assignment of Policy.*

Contracts of some companies do not permit the assignment of Industrial policies, to protect the company against insurance not of a bona fide character.

9. *Total and Permanent Disability Benefits.*

Where Disability Benefits are granted, the provision is much less complex than the usual Disability Benefit of Ordinary policies. The benefit usually covers total and permanent disability only from loss of eyesight, loss of two hands, two feet or one hand and one foot; one-half of the amount of insurance is payable when the policy becomes a Disability Claim and a paid-up policy is granted for one-half the amount of insurance.

10. *Participation in Surplus.*

While a substantial amount of Industrial insurance is written on a non-participating basis, most Industrial policies of recent years are written on a participating basis. Dividends are distributed annually but the first dividend is not usually paid until the end of the fifth year. The policyholder is not given the privilege of selecting one of a number of options with respect to the disposition of dividends. In view of the immense amount of detailed work such a privilege would involve, both on the part of the Home Office and the Field Force, one mode of distribution is followed. In some policies it is specified that the dividends will be distributed in the form of additional paid-up insurance, while in others it is provided that the dividends will be distributed in cash or allowed to apply on the premiums. The granting of dividends in the form of paid-up insurance rather than in the form of cash would seem to be more satisfactory, both from the standpoint of service to the insured and of convenience. A distribution of dividends annually in cash or in payment of a number of weekly premiums may make a distinct appeal to the policyholders. It is not likely, however, that the money so received in cash dividends will be as well invested

in cash, or in payment of a number of weekly premiums, may make as though used to purchase paid-up insurance. There would seem to be good grounds for making the distribution of dividends under Industrial policies at longer intervals than annually.

11. *Non-Forfeiture Values.*

Under modern Industrial policies, liberal non-forfeiture values are usually granted after three years from the date of issue if all premiums have been paid. Under some policies, however, no value is granted before the end of five years. The benefits are in the form of either term extended insurance, paid-up insurance for a reduced amount or a cash value.

Under most policies no cash value is allowed until the end of ten years, although some policies provide for a cash value at the end of the fifth year. Cash values in the early years of the average Industrial policy would be very small and not attractive to the policyholder. On the other hand, the granting of a cash value before the policy has been well established would cause a tendency toward a heavy lapse rate. The cash value is usually the full reserve on the table used in calculating the premiums, less a surrender charge until the end of 20 years. In the determination of this charge due consideration must be given to its relationship to the initial expenses and the requirements of the statutes. Paid-up values under modern policies are for a reduced amount of insurance, usually payable in the same event as the original policy. Under the extended insurance privilege the policy is continued for the full amount of the policy for a definite term. In the determination of the paid-up values and the term of extended insurance, a practical method is to use the reserve less a surrender charge (determined in the same manner as that in calculating the cash value), to purchase the paid-up insurance at net single premium rates on the table used by the company in calculation of premiums. Such table is usually the Standard Industrial table. If the surrender charge is sufficient, net single premium rates are justified in calculating paid-up insurance and the term of extended insurance where there would be a satisfactory margin to meet expenses and contingencies from the probable mortality savings and excess interest earnings.

The Automatic Privilege. It is usual for the company to make either the extended insurance privilege or the paid-up policy privilege automatic. The question as to which practice is preferable is

open to argument. If the extended insurance benefit is made automatic, one advantage is that the full amount of protection is continued on the lives of policyholders who, through financial hardship, are temporarily unable to meet the premiums. If the privilege were thoroughly understood by the policyholders it would be fairly satisfactory. Since the term during which an insurance benefit is granted is much shorter under the extended insurance privilege than under the paid-up policy, which is usually payable in the same event as the original policy, the company is under less expense of caring for this non-premium paying business under the extended insurance privilege than under the paid-up insurance privilege. On the other hand, policyholders not understanding the privilege are liable to be dissatisfied on finding at the end of the term that the policy has no value.

Under the paid-up policy privilege it can be more readily explained to a policyholder that fair treatment is being given, since a definite amount is payable under the same conditions as the original policy. The company, however, when premiums are not being collected, gets out of touch with the policyholder and the care and settlement of such policies involves considerable difficulty.

The premium loan privilege if included in Industrial policies and allowed as an automatic non-forfeiture privilege, would have points in its favor. In the event of the policyholder being unable to pay premiums, the premiums accumulated at interest would be charged up as an indebtedness against the policy and the full benefits of the original policy continued, subject to such indebtedness, for a specified term. Premium payments may be resumed on the policy within such term without evidence of insurability. The privilege would be of substantial service during a period of enforced unemployment, although involving distinct administrative difficulties on the part of the company.

While most of the above points are applicable in the case of ordinary insurance, they have more force in the case of Industrial policies, on account of the greater number of policies, the greater liability of Industrial policies to lapse, the much smaller size of the industrial policy, and through the fact that when premiums cease on Industrial policies, in a large proportion of cases the company loses all connection with the policyholder and many of the insured lives do not know that their policies have a value under an automatic nonforfeiture privilege.

THE SERVICE OF INDUSTRIAL INSURANCE TO THE COMMUNITY.

Probably the most apparent benefits of Industrial insurance are the great sums paid to policyholders in claims yearly. The claims paid on Industrial business amounted to over sixty million dollars in each of the years 1919 and 1920, while during 1918, a year marked by distress resulting from war and the epidemic of influenza, about ninety million dollars was paid to beneficiaries under Industrial policies in the United States and Canada. About thirty millions of people enjoy the comfort of protection under over forty-five million Industrial policies for an amount of insurance exceeding six and one-half billion dollars. These are stupendous figures and well illustrate the enormous scope of the business. The Industrial companies have a high reputation for promptness in settlement of claims. Responsible men in the field are, under certain conditions, permitted to make claim setttlements in order that the proceeds of the policies may be of most service. A large volume of Industrial insurance is written on Endowment plans. Large sums are paid on matured endowments written on the lives of children, at the time the insured attain early womanhood or manhood. These maturing policies impress on the minds of hundreds of thousands of people the great value of life insurance and systematic saving. The public funds have been greatly relieved by the reduction of pauper burials and from other forms of charitable relief.

The service of Industrial companies is not limited to the great sums paid to policyholders in the form of death claims, as matured endowments or otherwise. The great army of companies' representatives in the field are constantly encouraging and assisting millions of people in the habits of thrift. Vast aggregate sums are collected and carefully invested, a great proportion of which would probably otherwise be spent to small purpose. It is said that saving through savings banks and other agencies is greatly stimulated by this work. Policyholders are taught the necessity of carrying protection to dependents with the resulting increasing tendency toward better protection of the home through life insurance.

The intimate connection between the Industrial companies and the homes of the policyholders has been of great assistance in improving the living conditions of the policyholders. A great amount of statistical information has been obtained. Careful studies have been made of various diseases and occupations injurious to health

and the results of such research put to practical use. The companies have co-operated with public health bodies, assisted in educating the public through a wide distribution of publications dealing with health and other matters and have impressed on a great mass of people the value of right living. This great work of Industrial companies has undoubtedly resulted in a large saving in lives and an improvement in the health of the Industrial classes.

Abstract of Discussion of Foregoing Paper.

(WRITTEN DISCUSSION.)

MR. J. F. LITTLE:

Mr. Buchanan has provided us with an interesting résumé of the manner in which industrial insurance is conducted in the United States and Canada, thereby filling a void that has long been noticeable in our *Transactions*.

The author mentions that efforts to write industrial insurance on a monthly premium basis have hitherto not been successful. In Great Britain some measure of success has recently attended an effort to write endowments on the monthly premium basis in order to avoid the higher expense of collection involved in the weekly premium business. In the United States monthly premium business would, in many States, have to be treated as ordinary business, as the laws which exclude industrial insurance from the operation of certain provisos, which it would be practically impossible to meet in the case of this class of business, provide for such exclusion by the use of some such term as "weekly premium insurances."

Mr. Buchanan in mentioning the limitation of the amount of insurance which may be placed on the life of an infant indicates that such limit is operative only up to ten years of age. In point of fact the limit runs up to twenty-one years of age, and in some of the recent policies issued by industrial companies the ultimate amounts have been large enough to require reduction at ages beyond ten years. Mention of the fact that the limits at younger ages are rather low in view of present-day costs suggests that instead of increasing the limit of insurance at these younger ages a more modest funeral expenditure would be a better solution of the difficulty. It is, of course, intended that the amount of insurance payable on the death of an infant shall not exceed a reasonable expenditure for the funeral, together with some allowance for medical expenses.

Though probably not so intended, it might be inferred from his remarks that Mr. Buchanan regards the debit as consisting of the

premiums due on live policies after adjustment for premiums paid in advance or in arrears. The debit, however, is not affected by premiums paid in advance, or in arrears for less than four weeks (at the end of which period the policies are lapsed), the items referred to being, of course, taken into account in making up the weekly adjustment of collections by the agent.

The paper gives the number of policies on a debit as averaging between 750 and 1,500, but I find that in one large company the average debit covers at least 1,500 policies, and there are numerous debits running to over 2,000 policies.

It may be noted that the inspection of the debit made by the proper official is rather at irregular than regular intervals. The reason for this course is that if the agent knew exactly when his debit was due for inspection he would be in a position to make his arrangements accordingly, and temporarily straighten out any irregularities.

The paper draws attention to the fact that as a company grows in size the cost of collection decreases, due to the fact that in a given area the amount of premiums to be collected may be increased substantially with but little addition to the time required by the agent to cover the area. It may be added that the companies have of recent years taken vigorous steps to consolidate the debits. This last phrase may be explained by saying that in many instances an agent will write a policy outside his own prescribed field of operations, perhaps through knowing the family personally, and he is usually rather anxious, not only to write the policy, but to continue to collect the premiums as part of his own debit. If this were allowed, in process of time each agent would have a number of long-distance calls to make, which in the aggregate would use up a great deal more of his time than they were really worth to him. By transferring these cases to the agents in whose districts they actually are located their collection is made more convenient, and any individual agent is likely to gain as much by transfers to his own area as he is to lose by transfers from it. Special attention to this plan of consolidating debits has enabled the companies to substantially increase the average amount of the debits, with the result that the agents' earnings have been improved.

With regard to valuation, it may be noted that in Great Britain a rate of interest as high as 4 per cent. has been used. In that country also the actuaries have felt justified in making valuations far less stringent than are used in the United States today. As the Industrial policies are almost wholly non-participating in that country, the problem of reserve is viewed as a question as to what is necessary, in addition to so much of the future premiums as is not required for expenses, to enable the company to meet its obligations. Hence the very common practice of valuing the sums insured as the gross liability and offsetting that liability by valuing a fraction

of the future gross premiums, which is usually decidedly larger than the net premium according to the valuation tables adopted. As a result it is quite common for no reserve on adult life policies to be set up until five years after issue, and on endowments running for twenty years or more no reserve is set up until perhaps two or three years after issue, while on infantile policies, as the author states, no reserve is set up until after ten years of age has been attained. Of course, the stronger companies use substantially higher reserves, some of them making a strict net premium valuation.

Mr. Buchanan refers to the fact that the assumption that policies issued during any calendar year are taken for valuation purposes as if issued in the middle of the year results in a substantial error for first calendar year business on account of the heavy lapse rate. This error, however, is very much reduced by the end of the second calendar year, and is quite unimportant in the case of policies of longer duration. As an offset, these policies are valued, in the United States, on the assumption of yearly premiums, although they are true weekly premium contracts, and as such might be valued by the continuous method, resulting, of course, in somewhat heavier reserves. The suggestion that some allowances should be made for prospective lapses, because the amount of such probable lapses is considerable, would apply, of course, equally to Ordinary policies, as among these, also, there is a substantial lapse rate during the first twelve months or two years. In either case it would seem undesirable to make the adjustment in the valuation. If an allowance for lapses is to be made, it should either be made in the manner adopted by the State of Massachusetts or preferably by setting up an asset item, representing part of the money invested in the procuration of the business.

The fact that the mortality under industrial risks is higher than among the general population is due, of course, to the absence in the industrial business of a large fraction of the community who, when insuring, take out Ordinary policies. The experience of Ordinary and Industrial policies combined might be expected to run fairly close to the general population mortality.

In the matter of loading premiums, it may be pointed out that using yearly net premiums is, in the United States, convenient, since the valuation is made on the basis of such net premiums. The difficulty of assessing separately the cost of new business, owing to the fact that generally new issues, as such, are not paid for, but only the excess of new issues over lapses, renders any adjustment of the loading on the basis of first year and renewal expenses very much a matter of individual opinion. A uniform percentage loading at all ages of the net yearly premiums, with the resulting gross premiums divided by fifty-two to obtain the weekly premium, is common, and under the circumstances gives as accurate results as can be hoped for. As the great bulk of the field expenses is based on the amount of premium, while taxes are also very generally a

percentage of the premium income, it is only in respect of Home Office expenses that any departure from the ratio of flat percentage of premiums can be found in the expenses. At the older ages the average premium is higher than at the younger, and this would indicate that the proper loading should consist of a relatively small constant and a relatively large percentage. Net premiums, however, are generally taken on the Standard Industrial table, which unquestionably overstates the mortality, and as the resulting concealed loading is higher at the younger than at the older entry ages, the customary straight percentage loading is equivalent to a loading formed of a constant and a percentage on the net premiums by a table representing the true mortality experienced in the business.

Present-day Industrial insurance forms a striking illustration of the fact that necessity is the mother of invention. Normally the house to house collection of small weekly premiums, averaging something over ten cents each, with the relatively small size of individual contracts, might have been expected to result in an expense rate that would have rendered the business impracticable. The necessity for ingenious labor-saving systems has, as ever, produced results, and the present-day industrial policy bears an expense rate exceedingly low in view of the service rendered by the company and the small individual amounts which have to be dealt with. It is doubtful if any other business today can show a more successful handling of the difficult problems that have had to be overcome.

MR. R. V. CARPENTER:

Mr. Buchanan's paper is instructive, well written, and well balanced. He has packed a great deal of information, both general and technical, into the space he has allowed himself.

As Mr. Buchanan states, the term "Industrial Insurance," as used in the United States and Canada, usually implies the payment of weekly premiums. In New York State, the nearest approaches to a definition are found in Section 91 of the Insurance Law, referring to the licensing of agents, where reference is made to "agents operating solely for companies transacting industrial or prudential insurance on the weekly-payment plan of insurance"; in Section 84, relating to the valuation of "industrial policies written on the weekly premium payment plan"; in Section 89, relating to discrimination, where reference is made to "industrial insurance on a weekly payment plan"; and in Section 101, exempting "industrial insurance where the premiums are payable weekly" from the requirement of Standard Provisions. The Massachusetts Law refers in Section 75 to "policies of industrial insurance where the premiums are payable monthly or oftener," but in Section 80 to "policies of prudential or industrial insurance on which the premiums are paid weekly and are not more than fifty cents each";

while the valuation Section refers to "premiums by weekly payments" and "such weekly payment business." New Jersey and several other states have in the anti-discrimination statutes a reference to companies "transacting industrial insurance on a weekly payment plan." These references are significant because over ninety per cent. of the Industrial insurance in the United States is in companies whose head offices are in the three states mentioned. Missouri, Kentucky and Texas specifically define Industrial insurance as weekly premium insurance. Louisiana includes premiums less than a month apart, and Georgia, weekly or bi-weekly. The Canadian Act extends the term to include policies with premiums payable "at shorter intervals than quarterly."

Monthly premium business is almost unknown in America, but in the London Prudential, over 40 per cent. of the Industrial premium is derived from so-called "monthly" tables, and last year 77 per cent. of their premiums on new business was on this plan. Their "month," however, is a "lunar month" of four weeks.

Mr. Buchanan's estimate of forty-five million Industrial policies in the United States and Canada, with six and one half billions of insurance, understates rather than overstates the volume of the business, as Mr. Hoffman of the Prudential of Newark has recently made a tabulation for twenty-five Industrial companies, showing over forty-seven and one-half millions of policies at the end of 1920, with over seven billion dollars of insurance, the average policy being a little less than $150.

It is obvious that the great number of policies and the small average amount, together with the nature of the clientele, call for many special methods and practices which differentiate Industrial from Ordinary insurance. Simplicity must be the keynote. The "facility of payment" clause would not be applicable at all to Ordinary insurance, yet in Industrial insurance, experience has shown it to be the best sort of an instrument for accomplishing the just and prompt settlement of claims. States requiring Standard Policy Provisions exempt Industrial companies from either all or a part of these provisions. Guaranteed cash values in the early years are undesirable, because of the small amounts and the temptation to the policy-holder to give up his much-needed insurance. Provisions for policy loans would be impracticable because of the accounting needed to take care of small interest payments. Nevertheless, in cases of special need, cash values and loans are frequently granted. Complicated disability provisions are to be avoided. Giving policy-holders the *option* of taking dividends in cash or applying them to purchase additional insurance—so easily handled in Ordinary insurance—would involve an immense amount of labor in Industrial insurance. Because of the complications in accounting, I am inclined to question the practical advisability of applying the premium loan privilege, which Mr. Buchanan appears to favor, to Industrial policies.

The system of accounting with individual policy-holders differs radically from the Ordinary system in that it is done at the district office. The Home Office has no knowledge whether an individual policy-holder is in advance or in arrears, and deals only with the account of the agent in bulk. Correct accounting in the district offices is maintained by a system of inspections by Home Office representatives.

The distribution of surplus presents special problems. Here again simplicity is necessary, and certain refinements of Ordinary surplus distribution are impossible. The New York Insurance Law recognizes the difficulties in the provision that "in the case of industrial policies the share of surplus. . . shall be payable annually in such manner as may be determined by the company with approval of the Superintendent of Insurance." Strange as it may seem, one problem, where dividends are payable in cash or may be applied on premiums, is to get all of the dividends into the hands of the policy-holders. Payment of dividends in the form of permanent additions to the policy accomplishes this, for the most part, and involves the least expense. On the other hand, it has been maintained that the company should not force the policy-holder to use his dividends to increase his insurance, but that he is entitled to receive immediate advantage of the savings on his policy, in the form of cash or abatement of premiums. One virtue of allowing dividends in abatement of premiums is that they often save lapses. The company with which I am connected has adopted, as a plan that seems equitable and generally satisfactory, except for the expense involved, the method of allowing the larger portion of the dividends in abatement of premium, and a smaller portion in the form of mortuary or maturity dividends on death claims or maturing endowments,—these mortuary and maturity dividends being applicable to the claims for only one year at a time, and not being permanent additions. There are also special dividends to persons attaining advanced age. Because of high initial expenses, several years elapse before the reserve is made up. It may be added that over ninety per cent. of existing Industrial business in this country is participating, either by virtue of the policy contracts or by retroactive action on the part of companies that have mutualized. It is also a matter of interest, and, may I say, to the credit of the business of Industrial insurance, that prior to their mutualization, the two largest Industrial companies paid out or declared bonuses (corresponding to dividends on participating policies) amounting altogether over a series of years, to forty-nine millions and over twenty millions of dollars respectively, to the holders of Industrial policies which contained no provision or intimation whatever that they would share in surplus earnings.

It is inevitable that Industrial insurance, like every large undertaking, has not been free from attack. The principal objects of criticism have been (1) child insurance, (2) lapses, and (3) the

higher cost of Industrial insurance than Ordinary. It may be of interest to take these up in order.

Child Insurance.—Most of the agitation against the insurance of children took place from about 1890 to 1905. Prohibitive bills were introduced in many of the state legislatures and even in Congress. The weapons used against these bills were full publicity and statement of the actual facts of the business. In these battles the companies were ably assisted by the representatives of charity and welfare organizations, and the bills uniformly met defeat, except in Colorado, where a prohibitive law was passed. Agitation against child insurance, however, has become a thing of the past. The Armstrong Committee appointed in New York in 1905, after a searching investigation, stated that they were "without facts which would warrant the prohibition of insurance of children." Early this year the Colorado legislature substituted a permissive for the existing prohibitive act, and happily removed, let us hope for all time, the last vestige of the stigma which had existed against the character of the wage-earning classes of this country.

Lapses.—In the very early days of Industrial insurance, criticism of heavy lapses was not without some justification. The companies were not well organized, lapse rates were indeed heavy, and there were no non-forfeiture values. Conditions to-day have entirely changed, and to-day the rates of net termination of Industrial business compare not unfavorably with Ordinary business. One of the most notable achievements in the history of Industrial insurance is the success of the fight against lapses. In one company, the percentage of termination less revivals under Industrial premium-paying policies, to mean number in force, declined from 20.13 in 1900 to 6.67 in 1920. Even more impressive are the figures of this company's Industrial business for the first policy year, in which so large a proportion of the lapses occur. Several tabulations have been made, and the results are so remarkable that they are worth showing:

METROPOLITAN LIFE, INDUSTRIAL BUSINESS.

Policies Issued During—	Per cent. of Terminations (less revivals) during—			
	First Three Months.	First Six Months.	First Nine Months.	First Twelve Months.
1896	38.17	52.71	58.58	61.87
1903	26.96	39.90	46.03	49.89
May, 1909	22.34	32.08	37.50	41.10
December, 1911	15.86	26.18	31.86	35.13
1916	10.79	18.90	23.19	26.04
1917	8.71	16.21	20.15	22.66
1918	7.85	14.61	18.46	21.11

These results, in the company referred to, have been achieved by the better organization of the field force, improvement in the agency

personnel, continued admonitions to agents to save existing business and avoid writing business of poor quality, and by the system under which the compensation of District Managers, Deputies and Agents is made to depend to a considerable extent upon the persistency of the business. Agents, in addition to their collecting salary, are paid on the basis of "increase." That is, if an agent writes new business carrying a weekly premium of $1.00 and lapses $0.25, he is compensated on the basis of a certain number of times $0.75. The encouragement of revivals is also an important factor, as every revival offsets a lapse. Revival is made as easy for the policy-holder as is considered consistent with safety. Many policies are revived by charging arrears against the policy as a lien bearing five per cent. simple interest, and where a family group desires a revival, and there are policies with insufficient reserve to carry the lien, the arrears on two or more policies may be charged against any policy in the group which can carry it.

As Mr. Buchanan states, most lapses are a loss to the insurance company, and they are heaviest in the early weeks of the policy. Many applicants pay but one weekly premium and get protection for five weeks.

High Cost.—The Industrial policy-holder necessarily pays for his insurance at a higher rate of premium than the Ordinary policy-holder. The reasons are to be found in higher mortality and a higher expense rate.

Comparison of Industrial and Ordinary mortality is not an entirely simple matter, because of a number of complications, such as the greater effect of selection in Ordinary business, and the fact that Industrial mortality is improving rapidly—apparently more rapidly than Ordinary—and any fair comparison must be of contemporaneous experiences. On account of the limitations of time, I have not attempted any exact comparisons. Some idea of the excess of Industrial mortality may be derived from the fact that in 1917,—the last year preceding the disturbing influence of influenza,—the Industrial mortality of the Metropolitan Life on white lives between ages 25 and 50 varied from about 150 to 200 per cent. of the ultimate mortality under the American Men Table, the maximum excess being at age group 35–39. From ages 50 to 70 the excess ran roughly between 150 and 125 per cent., decreasing with the advance in age. In 1920 the mortality was more favorable than in 1917.

The higher expense rate of Industrial insurance is due, of course, to the amount of detailed work involved in caring for great numbers of small policies, and to the service which the Industrial company renders to the policy-holder in sending an agent around to his home each week to collect the premium. A high expense rate in any line of activity cannot be justly criticized, however, if the service rendered is commensurate with the expense, and this we believe is the case with Industrial insurance. In at least one large company the

policy-holder may obtain a refund of ten per cent. of his premiums if he is willing to forego the services of the agent by paying his premiums direct to the Home Office or a District Office. The Industrial companies have succeeded, by improved administrative methods, in greatly reducing the expense rates during the past twenty years, although recently this improvement has met with a check on account of such items as increased cost of supplies, higher rents, and higher compensation required to give employees a living wage, also on account of the unprecedented increase in new business.

As the result of decreased mortality and expenses, the benefits in Industrial policies for a given amount of premium have materially increased. In one company, the insurance for a five-cent premium, Whole Life plan, has increased,for age 10 at entry, from $120 in 1906 to $162 at the present time; for age 20, from $87 to $113; age 30, $67 to $82; age 40, $50 to $58; age 50, $35 to $38. Moreover, premiums on the 1906 policies were made payable throughout life, while on present issues they cease on the anniversary after age 74, and policy conditions generally are more liberal. On Infantile policies the increases in benefits are even greater.

One very important development in life insurance which is the direct outcome of Industrial insurance, is the development of what are known as "Intermediate" policies. These are primarily $500 policies, with premiums payable annually, semi-annually or quarterly, issued on the customary Whole Life, Limited Payment Life or Endowment plans. As the name implies, they stand between Industrial policies and the usual Ordinary policies for $1,000 and upward. The first Intermediate policies were issued in 1896, and have ever since been issued in very great numbers by the large Industrial companies. These policies play an important part in our social economy in providing insurance for large numbers of wage-earners who feel that they cannot afford the larger Ordinary policies, yet are able to pay premiums at longer than weekly intervals, and thereby avoid the added expense incidental to Industrial insurance.

Any account of Industrial insurance would be wholly incomplete without reference to the health and welfare work to which Mr. Buchanan refers in his closing paragraph. The appropriateness of this sort of work for Industrial companies would seem to be beyond question. With fire insurance companies striving after fire prevention and casualty companies spending large sums for the prevention of accidents, is it not reasonable that life insurance companies should devote a very considerable portion of their energies to the conservation of that most precious possession, human life, and is it not particularly fitting that the Industrial companies, in close touch as they are with those elements of our population who know so little of the laws of health, should devote very special efforts to this cause? The industrial company, in a peculiar way, has a double opportunity. Through its agency force, going directly into policy-holders' homes, often their friends and counselors, the company has an unparalleled

opportunity of conveying to these policy-holders such messages on behalf of their health and welfare as it considers desirable to send. On the other hand, the great amount of material coming into its Home Office, through death claims and otherwise, together with the availability of the agency force for gathering statistical data, gives the company an unusual opportunity for the study of facts relating to health and the common weal.

These opportunities have not gone by unnoticed. Probably every Industrial company of importance has a policy-holders' magazine, and probably in every case this is to a certain extent a health magazine. The larger companies have also published additional health literature, conducted Home Office studies, and in other ways aided in health work.

The company with which I am associated has entered into health and welfare work to an unprecedented degree. For many years it published its health magazine and other health literature. In 1909, however, the company determined to enter more intensively into health and welfare work, and since that time it has devoted a great amount of energy to work of this nature.

One of the most important branches of the work is the Nursing Service, inaugurated in 1909. This service has been established in the principal cities and towns, about 2,700 in number, and is available to any Industrial policy-holder in need of the service, under established rules. Last year over 1,600,000 visits were made. Another important activity is the widespread distribution of pamphlets and leaflets at the rate of fifteen or twenty millions yearly, dealing with the principal preventable diseases and a large variety of health topics. Welfare exhibits are frequently held at county fairs and similar occasions. The officers and field representatives are contiuously cooperating with social agencies, schools, health departments, etc., in matters of public health. The members of the Field Force assist in, and sometimes inaugurate, "Clean-up Campaigns" and "Baby Weeks," and frequently assist in securing enactment of health legislation. Last year an active campaign was carried on in California and Oregon which played a part in defeating proposed anti-vaccination amendments in those states. Numerous studies of mortality and morbidity have been conducted, and many sickness and other field surveys have been made, resulting in the accumulation of valuable material and sometimes in concrete recommendations to remedy unfavorable conditions disclosed. I will not weary you by enumerating the investigations that have been made, except to mention one of the most important, a community tuberculosis experiment, known as the "Framingham Experiment." In 1916 the company suggested this experiment to the National Tuberculosis Association, offering an appropriation to carry on the work, and the offer was accepted. The experiment consists of the adoption by the city, which has extended its hearty cooperation, of certain special measures relating to medical examinations, surveys,

medical and nursing care, dispensary and institutional treatment, etc., with the view of determining to what extent tuberculosis can be controlled. The experiment was started in 1916, and the degree of its success and importance can be partially measured by the fact that in 1920 the tuberculosis death rate for the city was 64 per 100,000, against an average of 121 for the decade preceding the experiment.

The company's justification for its welfare work is not alone that it is is beneficent, but that it saves insured lives, and saves *a great many* lives. Just how many we of course do not know. We do know that our Industrial death rate is decreasing to a marked degree, and calculations have been made showing that our death rates for certain important preventable diseases have declined more rapidly than the corresponding rates indicated by United States Census returns. We do feel that eleven or twelve millions of nursing visits to people many of whom know so little about personal hygiene, and the dissemination of over two hundred million pieces of health literature, in addition to the company's magazine, among these people, must inevitably have brought about significant results in the saving of lives and the prevention and cure of disease, not only among our own policy-holders, but to a certain extent among the general population. This story of health and welfare work is of course familiar to many of the members of the Society, but I feel that you will be indulgent, because this work is to-day so important a part of Industrial insurance that the record would be far from complete if it were not briefly described.

(ORAL DISCUSSION.)

MR. E. A. LUNDGREN:

In this connection it might be of interest to mention that it is not an uncommon thing among European industrial companies to grant postponement of premiums in case of strikes and lockouts. Premiums thus postponed are first liens against the policy and draw a certain rate of interest, and the insured has the option of either paying the premium with accumulated interest in one sum or to resort to the instalment plan. The provision can be considered as a substitute for the automatic extended insurance provision which, as you know, is frequently missing in many classes of industrial insurance policies issued abroad, but differs from that provision inasmuch as the extension is granted without regard to the reserve or surrender value under the policy.

Another point of interest is that certain industrial companies abroad are issuing combined health and life insurance policies in which the health insurance feature is non-cancelable. The sickness benefit, usually a function of the weekly or monthly premium, starts after various waiting periods, such as one week, two weeks,

up to three months, and is payable during the whole period of illness. The benefit is limited to sicknesses occurring before sixty or sixty-five. This kind of policy has been issued in one country since 1909, and so far the experience has proven to be distinctly satisfactory; and I might also mention that ordinary life policies with non-cancelable and unlimited health provisions have been issued with, on the whole, satisfactory results. Non-cancelable and unlimited health insurance provisions are not such undesirable features after all. The main thing is to ascertain the risk and charge premiums accordingly, bearing in mind that age and occupation have great influence on the risk in question.

MR. S. Z. ROTHSCHILD:

A couple of points came to my mind which I thought might be of interest, particularly as the company with which I am connected is writing at the present time industrial insurance on babies from birth. In 1902 we started to write them from three months old, and we have found the experience so satisfactory that in February of last year we started to write them from birth. Our general industrial experience, in the light of what has been said about the mortality of industrial insurance, might be interesting.

We have had, based on the American Experience table, a mortality of 60 per cent. of the expected on our industrial business last year, 1920. This year it will be much better. In fact, with an increased amount of insurance in force, we have paid so far this year less in death claims in amount than we paid up to this time last year. Based on the premium income, which is sometimes used, particularly by the non-technical men of the company, last year we had about 15 per cent. of our income as a mortality payment; this year it has run about 13½% so far. This may be due to the fact that about 50 per cent. of our business—I don't know the figure exactly—is under fifteen years of age. I refer to the age of the insured, not of the policy. We have specialized very largely on the infants and younger children. The difference between this experience and that of other industrial companies—of the larger companies—is possibly due to that fact. This has, we find, kept the mortality down, although, of course, we know the death rate amongst babies is very large, but in relation to the expected our experience has been very satisfactory.

In making this investigation of our mortality we used the American table in connection with which an extension below age 2 had been constructed by the late Clayton C. Hall, formerly Actuary of the State of Maryland and a Fellow of this Society.

This question of expected mortality based on the American Experience table may in itself not mean so much when we consider the applicability of the American Experience table to industrial insurance, so I would like to just emphasize one other idea to which

I have referred, and that is the ratio of the claims to the premium income which then leaves out the question of expected mortality. Our ratio so far this year is about 13½ per cent., and last year it was about 15 per cent., and if Mr. Craig will tell me about what the general average is of the ratio of claims to premium income in industrial insurance, we can possibly then see what the effect of the younger average age of our insured really is—what the general experience of the large companies is as compared with the 13½ per cent. which we are experiencing at the present time. I might add that the ratio of the number of death claims so far this year to the number of policies in force at the beginning of the year will, if continued at the same rate for the year, give us a death rate of 6½ per 1,000, or less than half of a favorable population mortality rate.

The laws of at least three of the States prevent the writing of insurance on babies under one year of age, but I think, in addition to what has been said so far on the laws against baby insurance, that there is a real field for this insurance, which will grant a burial benefit and a little more for medical expenses for children before they are a year old.

There are just one or two other points I will touch on briefly. Something was said about the agents, and the very small number of defalcations on the part of the agents. I want to touch upon that from a different viewpoint. Last year we permitted our agents to inspect all babies under a year old and pass in the cases without any further examination or inspection. During the latter part of the year we staged a contest. If an agent wrote a certain amount of business, particularly of babies, in new homes, we gave certain bonuses. The result was that a considerable amount of business that was written was entirely fictitious. The people were put in and the agent paid the premiums, and the children did not exist at all. It paid them to pay the premiums in order to gain their bonuses. We thought we were saving the cost of inspection, and this might be interesting also as touching upon the other paper on the elimination of medical examiners. We thought we would save the inspecting expenses and also facilitate the speed with which business went through if we did not inspect, but left it up to the agents. That was our experience, and we got a great deal of business on streets in which there were no houses at all, and it was interesting to see the originality of the agents in the way of the invention of names.

We caught that up when an agent finally cut his own throat, as he will do when he does anything like that. There was a day when it didn't pay him to hold the cases, and we inspected and found there was no such business in existence, and we have made the agents come through with a return of everything they got, by threatening legal proceedings—and we have now put our inspectors back to inspecting babies again.

The number of premiums which were paid on those—which measured the length of time in force and hence the duration—were very few, because it wouldn't have paid the agent to keep it in force very long. It was only shortly before this contest closed that this practice was started, and it was immediately after the contest was closed, when we made our inspections after these men got out, that those cases were wiped off our books. Therefore, there were but very few premiums, possibly two or three or four at the most paid on any one of those cases, so it meant a very small addition to our "exposed to risk." And let me add that this year we are inspecting all risks and we have no such fraudulent cases, and our mortality so far has been considerably below last year.

Another interesting point in industrial insurance which has hardly been touched on is that of mortality among women. There has been some expression of opinion on this in our *Transactions* before. I hesitate to say what percentage, but it is such a vast majority that we might say 80 or 90 per cent. of business in industrial insurance is done through the women. It is the woman who takes care of it, and she pays for the insurance out of what is allowed her each week by her husband. She is the one who insures the whole family. The husband sometimes hardly knows about it, and the doctor has to be diplomatic, or the inspector, when he sees the husband, sometimes not to let him know exactly what he is being examined for, because the woman says her husband objects to insurance strenuously and if he knows, he won't be insured, and she wants that protection.

The women have been educated up to industrial insurance to a marvelous extent, and because of the fact that it is done through the women, our experience has shown that the mortality amongst the women themselves is certainly as good, if not a little better, than among the men in industrial insurance, and I am preparing my cards at the present time in order to test out the mortality experience among the different types or classes of women; that is, the spinsters and married women, those with husbands as beneficiary and those with children as beneficiaries, and widows. I think there is some interesting data to be gotten along that line, particularly in comparison with ordinary experience along similar lines.

On surrender values, I hark back again to the fact that the women take the insurance; women are not the ones who come in and want the cash when they can't pay. They do their best to pay their insurance. In fact, we have often found, through our men who have so reported, that women would rather give up the necessities of life than give up their insurance in a great many cases, but in the old days, particularly before the new epoch, which is known now as B.P.—Before Prohibition—the man would go out of a Saturday night and spend his week's earnings, and would be in on Monday morning with the insurance policies that were held on the

members of his family, asking for their cash value. The wife objected, but she didn't have very much to say. She had kept up the insurance out of her allowance, and when the husband needed extra cash he would bring in the policies and cash them in and the wife was without protection. She tried to revive them later on, but sometimes members who were insured were not any longer insurable because of ill health or for other reasons, and she lost this protection.

We decided that it was unfair to the woman and to her family to allow her to be subject to the whims of a husband who did not take the insurance seriously and to lose this protection, and now in the event of lapse we grant only paid-up insurance. Insurance is what the original insured want, and that is what we are willing to give. We find frequent complaints—not so frequent at that, but a number of them—where people come in and want their cash value because they can get it in industrial policies in some other companies, but we have tried to explain that, for the protection of the large number, rather than for the individuals who might really deserve their cash, we do not allow cash surrender, and we have succeeded in training our people pretty well to be satisfied with paid-up values instead of cash, which is, after all, a very small sum.

I want to add this one statement. Talking about the cost of industrial insurance and how long it would take the young company to get on its feet, I might mention that in one district which we opened, and in which we progressed very rapidly, it took us nine years to put the district on its own feet; that is, to cover all expenses, pay claims, and set up our reserve. From that time on considerable surplus was accumulated, but it took nine years to catch up.

Mr. J. M. CRAIG: Do you have any colored risks, Mr. Rothschild?

Mr. ROTHSCHILD: We have some still on our books from the time we used to write them, but we no longer write them. We have not written any for possibly ten years.

MR. JOHN K. GORE:

It seems to me that Mr. Buchanan and those who have commented on his paper have covered all the essential facts. There is just one thing that I should like to refer to from a different standpoint. Mr. Buchanan has spoken of the high expense rate of the industrial companies, which he has explained by the fact that the premiums are collected weekly and at the homes of the insured. Now that, while it is one of the causes of objection to Industrial insurance, is probably the one great reason why there should be Industrial insurance. If it were not for that fact our Industrial classes would probably not be protected by life insurance. Most of you are familiar with the fact that fifty-six years ago the post-office industrial insurance system was established in England.

There are no agents and the insured have to go to the post offices to pay their premiums. The system has been a practical failure. Less than four hundred policies are issued annually. That is one illustration of the fact that the Industrial classes not only will not, but that they can not, go to offices to pay their premiums. The father has to leave too early for his work and he returns too late to go out and pay premiums. The mother can't leave home on account of her household duties. If she could get away occasionally, it would cost car fares to go to and from the insurance office. So without agents there would be no Industrial insurance; there would be no protection for the Industrial classes if it were not for this house-to-house weekly system.

(AUTHOR'S REVIEW OF DISCUSSION.)

MR. J. D. BUCHANAN:

I am very much pleased with the great amount of information that has been brought out in the discussion.

Mr. Little refers to the limitations of the amount of insurance which may be written on the life of a child. While the statutes generally limit the amount of insurance, as Mr. Little points out, up to the age of 21, the chief object of such legislation was to obstruct any possible abuses in the insuring of young children. I am very glad that Mr. Little referred to the definition of "debit," as this was not made clear in the paper. In the matter of valuation it was not my intention to suggest introducing a lapse factor to reduce the reserve liability required during the first two years of insurance. It would seem to me, however, that the effect of lapses is an added argument in favor of making an allowance in the early years of the policy. Mr. Little's remarks on the method of loading and valuation and on other particulars of the business are very instructive.

Mr. Carpenter makes interesting reference to the definition of Industrial insurance and to some points of difference between Ordinary insurance and Industrial insurance, including remarks on the policy contracts and the plan of accounting. His statements respecting the distribution of profits are particularly impressive. It is of great public interest that such large sums were paid out in profits on policies that were non-participating according to their terms. Mr. Carpenter refers to the three main points of criticism of Industrial insurance and shows the remarkable success Industrial companies have had in overcoming such difficulties. I am very glad, indeed, that Mr. Carpenter gave so much information with regard to the welfare work done by Industrial companies among their policyholders. This is an extremely large factor in their service to the community.

We are indebted to Mr. Lundgren, who has told us of some of

the distinctive features of Industrial insurance in Europe. Mr. Rothschild's remarks respecting the writing of insurance on children go to indicate the necessity of adequately supervising the field work of an Industrial business. Mr. Gore emphasized a fact which is probably not generally fully realized by those not engaged in the business of Industrial insurance. He points out that were it not for the service of Industrial insurance companies there would be a great proportion of the population uninsured who are now policyholders under Industrial contracts.

Value of Business Reinsured in Bulk.

BY

ADOLPH A. RYDGREN.

This paper treats of the value of business reinsured in bulk. The importance of this subject is evidenced by the fact that during the past ten years, over eighty American life insurance companies have retired by reinsuring their business in other life insurance companies.

The retiring of a life insurance company by reinsuring its entire business in another life insurance company is usually accomplished in either of two ways:

(*a*) The retiring company may transfer cash or selected assets to the reinsuring company, equal in value to the liabilities under the reinsured policies less the price the reinsuring company has agreed to pay for the acquisition of the business; or

(*b*) The reinsuring company may buy the capital stock of the retiring company, thus acquiring all of that company's assets whether good, bad or indifferent, and of course assuming all of its liabilities.

Whatever method be employed in acquiring the entire business of another company, the legal liabilities under the policies the reinsuring company has assumed, will usually be greater than the real value of the assets it has acquired as the result of the transaction. The excess of such liabilities over the real value of such assets is the price the reinsuring company pays for the acquisition of the business. That price is frequently expressed in terms of each one thousand dollars of insurance acquired.

The fact that a company can afford to pay a price for reinsured business, implies the expectation of future profits. The expected profits are of two kinds: (1) the profits expected to be derived from the reinsured business, and (2) the value to the reinsuring company of the agency force that may be acquired, and the value of the increased importance the acquisition of the reinsured business

brings to the reinsuring company. Only the profits expected to be derived from the reinsured business will be considered in this paper, as the value of an agency force and the advertising value of increased size are hardly to be reduced to actuarial computation. The profits that are to be derived from the reinsured business will consist of the sum of excess interest, saving in mortality, loadings, and the surrender charge exacted upon lapse or surrender, less the expense of handling the business including taxes and commissions, and less dividends under participating policies.

Rate of Termination after Reinsurance.

Before describing a process of estimating the present value of profits expected to be derived from reinsured business, I wish to refer to the rate of termination of business after reinsurance. In order to determine whether business reinsured in bulk is subject to excessive lapsation as the result of the reinsurance, a number of companies were requested to give their experience for the purpose of this paper,—a request to which they very generously responded. Their experience in this respect is shown on the following pages.

The termination rates of the various groups of business represent in the case of the "calendar year of reinsurance" the ratio of the decrease in the amount of insurance between the date of reinsurance and December 31, of the same year, to the amount of insurance in force on the date of reinsurance; and in the case of the first or any subsequent "calendar year after reinsurance" the termination rates represent the ratio of the decrease in the amount of insurance during the calendar year to the amount of insurance in force at the beginning of the calendar year. The termination rates, therefore, include all kinds of terminations, including terminations by death, expiry, and maturity, as well as terminations by lapse and surrender; moreover, they do not include changes to term extended insurance, except insofar as the amount of term extended insurance is less than the face amount of the original policy.

In attempting to draw conclusions from the figures shown herein, it should be borne in mind that terminations allocated to any particular calendar year, are terminations as made on the books of the company during that calendar year; for example a policy lapsing on account of the nonpayment of a premium due in December, 1917, would be in force under the grace provision on December 31, 1917, and would be terminated on the books of the company in 1918, thus

appearing among the 1918 terminations upon which the termination rates for the year 1918 are based. Then some companies may consider lapsed on December 31 all policies where a premium due prior to December 1 has not been paid, and other companies may consider lapsed on December 31 only those policies where a premium due prior to some other date, perhaps November 1, has not been paid. While these figures, therefore, do not represent the lapse rate in which we are particularly interested, namely, the rate of voluntary nonpayment of premium by policy years, yet they do clearly reveal the tendency of that lapse rate, and they do suggest, even though very roughly, what that lapse rate actually is.

TERMINATION RATES OF COMPANY NUMBER 1.

Calendar Year of Issue, Preceding Reinsurance.	Calendar Year After Reinsurance.			
	0.*	1.	2.	3.
10th	.11	0	.10	0
9th	.08	.03	.02	.04
8th	.06	.04	.04	.02
7th	.08	.05	.07	‡
6th	.11	.05	.07	.04
5th	.09	.05	.04	.03
4th	.14	.06	.02	.02
3rd	.15	.05	.04	.02
2nd	.28	‡	.04	.04
1st	.35	.10	.06	.01
0th†				
All issues combined		.035	.045	.024

* 10 months.

† No insurance issued.

‡ Business increased.

Although the termination rates for the "calendar year of reinsurance" (Col. "0" of above table) were based upon only ten months' exposure to termination—being the ratio of the amount terminated in those ten months to the amount in force on the date of reinsurance—the termination rates are fully double those of the "first calendar year after reinsurance."

The termination rates experienced by Company Number 2 comprise all terminations, including changes from premium paying to term extended insurance. There was, however, comparatively little insurance changed from premium paying to term extended insurance, because the amount of term extended insurance remained

TERMINATION RATES OF COMPANY NUMBER 2.

Calendar Year of Issue, Preceding Reinsurance.	Calendar Year After Reinsurance.		
	0.*	1.	2.
14th	†	.30	.07
13th	†	.26	.03
12th	.03	.07	.07
11th	.03	.10	.04
10th	0	.08	.08
9th	0	.02	.07
8th	.07	.03	.05
7th	.03	.07	.05
6th	.03	.04	.02
5th	.03	.06	.04
4th	.05	.06	.02
3rd	.06	.10	.10
2nd	.09	.10	.06
1st	.22	.14	.09
0th	0	.43	.09
All issues combined			.064

* 3 months.

† Insurance increased.

practically constant, the ratio of term extended insurance to total insurance in force increasing from .025 on the date of reinsurance to .034 two years and three months later. It would, therefore, appear that in this group of business at least, the excessive terminations following the reinsurance were, among policies three or more years in force, largely surrenders for cash.

TERMINATION RATES OF COMPANY NUMBER 3.

Calendar Year of Issue, Preceding Reinsurance.	Calendar Year After Reinsurance.				
	0.	1.	2.	3.	4.
4th	.03	.14	0	.03	.02
3rd	.18	.19	.05	.01	.01
2nd	.14	.15	.10	0	.01
1st	.65	.16	0	0	0
0th*					

* No insurance issued.

Almost a full year's terminations are included in the "calendar year of reinsurance." Terminations were excessive for at least two years following reinsurance.

TERMINATION RATES OF COMPANY NUMBER 4.

Calendar Year of Issue, Preceding Reinsurance.	Calendar Year After Reinsurance.		
	0.	1.	2.
9th	.05	.03	0
8th	.15	.09	0
7th	.07	0	.07
6th	.12	.04	.08
5th	.12	.06	.09
4th	.19	.08	.03
3rd	.13	.08	.02
2nd	.14	.04	.07
1st*			
0th*			

* No insurance issued.

The period during which the policies of Company Number 4 were exposed to termination in the "calendar year of reinsurance" was not given.

TERMINATION RATES OF COMPANY NUMBER 5.

Calendar Year of Issue, Preceding Reinsurance.	Calendar Year After Reinsurance.			
	1.	2.	3.	4.
4th	.09	.04	.06	.01
3rd	.18	.06	.06	.02
2nd	.22	.17	0	.02
1st	.23	.14	.05	.01
0th	.34	.13	.01	.01

Less than one month's terminations occurred in the "calendar year of reinsurance," the data for which were not given. Terminations in this group of business seem to be excessive for two years following reinsurance.

TERMINATION RATES OF COMPANY NUMBER 6.

Calendar Year of Issue, Preceding Reinsurance.	Calendar Year After Reinsurance.			
	1.	2.	3.	4.
7th	.04	.01	.09	.01
6th	.06	.03	.03	.05
5th	.06	.05	.03	.04
4th	.06	.04	.03	.04
3rd	.08	.05	.04	.05
2nd	.10	.05	.05	.04
1st	.14	.05	.06	.04
0th	.29	.05	.02	.06
All Issues Combined		.044	.040	.042

This business was exposed to termination for seven months in the "calendar year of reinsurance," the data for which were not given. About one-half the lapses occurring when the first premium due after reinsurance became payable, were thus included among the terminations of the "first calendar year after reinsurance."

TERMINATION RATES OF COMPANY NUMBER 7.

Calendar Year of Issue, Preceding Reinsurance.	Calendar Year After Reinsurance.	
	1.	2.
10th	.04	.18
9th	.16	.03
8th	.06	.17
7th	.04	.04
6th	.06	.06
5th	.06	.04
4th	.07	.04
3rd	.09	.06
2nd	.13	.06
1st	.20	.10
0th	.29	.12
All Issues Combined		.069

This business was exposed to termination for nine months in the "calendar year of reinsurance," the data for which were not given. Only one-fourth of the lapses occurring when the first premium due after reinsurance became payable, were thus included in the terminations of the "first calendar year after reinsurance."

TERMINATION RATES OF COMPANY NUMBER 8.

Calendar Year of Issue, Preceding Reinsurance.	Calendar Year after Reinsurance.	
	1.	2.
11th	.05	.06
10th	.03	.01
9th	.04	.04
8th	.13	.07
7th	.23	.09
6th	.13	.05
5th	.13	.05
4th	.17	.05
3rd	.09	.08
2nd	.13	.06
1st	.17	.09
0th	.33	.08

This business was exposed to termination for eight months in

the "calendar year of reinsurance," the data for which were not given. While only one-third of the lapses, occurring when the first premium due after reinsurance became payable, were included in the data upon which the terminations for the "first calendar year after reinsurance" were based, the termination rates for that year are nevertheless excessive. I have been advised that the company originating this business had been exceedingly lax in the collection of loan interest, preferring to add the interest to the principal rather than to request its payment, and had been freely accepting note settlements of renewal premiums where no cash value existed to give security to such notes. The reinsuring company very properly sought to correct this condition, but in doing so undoubtedly caused considerable dissatisfaction, which resulted in excessive lapsation.

TERMINATION RATES OF COMPANY NUMBER 9.

Calendar Year of Issue, Preceding Reinsurance.	Calendar Year After Reinsurance.		
	1.	2.	3.
6th	.07	.05	.04
5th	.04	.04	.05
4th	.08	.01	.04
3rd	0	.07	.04
2nd	.08	.03	.02
1st	.10	.08	0
0th	.44	.36	*
All Issues Combined		.055	.031

* Insurance increased.

This business was exposed to termination for eight months in the "calendar year of reinsurance," hence only one-third of the lapses occurring when the first premium due after reinsurance became payable, were included among the terminations of the "first calendar year after reinsurance."

TERMINATION RATES OF COMPANY NUMBER 10.

Calendar Year of Issue, Preceding Reinsurance.	Calendar Year After Reinsurance.			
	1.	2.	3.	4.
4th	.22	.12	.04	.09
3rd	.16	.15	.08	.05
2nd	.26	.15	.17	.13
1st	.43	.25	.04	.05
0th	.75	.15	.13	.04
All Issues Combined		.173	.107	.079

This business was exposed to termination for only two months in the "calendar year of reinsurance," thus most of the lapses occurring when the first premium due after reinsurance became payable were included among the terminations of the "first calendar year after reinsurance." The terminations in this group are excessive even during the "fourth calendar year after reinsurance."

Only the termination rates for the entire business, all years of issue combined, were given in respect of the following companies. An inspection of the termination rates during the "first calendar year after reinsurance" experienced by Companies Numbers 1 to 10, inclusive, indicates that the termination rate for this year means nothing unless shown separately for each year of issue; therefore in the following tables, the termination rate for this year is omitted.

TERMINATION RATE IN VARIOUS OTHER COMPANIES—ALL YEARS OF ISSUES COMBINED.

Company Number.	Calendar Year After Reinsurance.		
	2.	3.	4.
11	.08	.07	.07
12	.09	.06	.06
13	.13	.19	
14	.03	.05	
15	.07	.03	.02
16	.05	.04	.03
17	.05	.04	.03
18	.01	.04	

It was explained in respect of Company Number 12, that immediately prior to the reinsurance many policyholders learning of the poor financial condition, borrowed the maximum amount available under their policies and then allowed their policies to lapse. The business of Company Number 13 was largely new business when it was reinsured.

An inspection of termination rates by year of issue and year of termination, reveals the presence of a small amount of five and ten year term insurance, and perhaps some ten year endowment insurance, but so little as to have no appreciable effect upon the termination rates for all years of issue combined. These termination rates may, therefore, be regarded as representing only terminations from death, lapse and surrender, leaving unknown, except in the

case of Company Number 2, the amount of premium paying insurance converted into extended term insurance.

The evidence is clear that reinsured business is subject to excessive termination during at least the year immediately following reinsurance, that in many cases the terminations do not become normal until two years after reinsurance, and that in extreme cases the normal termination rate is not attained until four or five years after reinsurance.

There are several causes of the excessive lapsation which immediately follows reinsurance. It is but natural that some policyholders should be disturbed by the transaction. The fact that his company has gone out of business, notwithstanding the fact that his policy is guaranteed in full by the reinsuring company, may cause a man to doubt the stability of life insurance companies in general, particularly the smaller companies, and the reinsuring company is in most cases one of the smaller companies. Every person who suffered the loss of position or expected profits as the result of the transaction, is a possible source of disturbance; not infrequently such persons take every opportunity of discrediting the reinsuring company. Then again reinsured business is especially vulnerable to being twisted, particularly by agents who had been connected with the retired company and who are not under contract with the reinsuring company. The reinsuring company should, therefore, take some measures to allay the doubts and to gain the confidence of its new policyholders acquired by the reinsurance transaction, in order to reduce such lapsation to a minimum. Aside from the value of the agency force of the retired company, the acquisition of those agents is also important in its bearing on the persistency of the business.

In estimating what profits may be derived from the reinsured policies, allowance must be made for the excessive lapsation that may be expected to immediately follow reinsurance. Such lapsation not only reduces the chance of earning profits in the future, but may also seriously affect the mortality of the business remaining in force.

A Method of Estimating the Value of Future Profits from Reinsured Non-participating Business.

While under participating policies the reinsuring company must at least share with the policyholders any profits that may accrue,

under non-participating policies the reinsuring company retains all such profits. These profits consist of (*a*) the interest earned on the funds of the reinsured business in excess of that required to maintain the reserve; and (*b*) the excess of the net mortality expected according to the mortality table used in the calculation of reserves, over the actual net mortality; and (*c*) the excess of gross premiums over net premiums, and (*d*) the excess of the reserves under policies where the payment of premiums is discontinued, over the surrender values allowed; less (*e*) the expense entailed in handling the business including taxes and commissions.

It is at once apparent that the profits from reinsured policies will vary with the plan of insurance, the age at entry, and the duration of the policies; therefore a classification, as for valuation, of the insurance in force on the date of reinsurance, is necessary if an accurate estimate of future profits is desired. In view, however, of the amount of labor involved in dealing with every plan and age at entry, and since such uncertain factors as the future lapse, interest and mortality rates enter into the calculation of future profits, practical considerations suggest a grouping of plans and ages of entry as illustrated by Table I.

TABLE I.

DISTRIBUTION IN AGE GROUPS OF INSURANCE IN FORCE OF ANY YEAR OF ISSUE.

Age Group at Entry.	Mean Age of Group at Entry.	Ordinary Life.	Twenty Payment Life.	Twenty Year Endowment.	Twenty Year Term.
Under 21.....	19	$ 5,000	$ 36,400	$ 9,900	$ 0
21–25.....	23	45,500	111,000	19,700	1,800
26–30.....	28	64,100	101,100	12,800	4,000
31–35.....	33	86,800	85,100	11,700	8,800
36–40.....	38	85,200	59,200	6,800	13,400
41–45.....	43	61,200	35,900	4,100	12,700
46–50.....	48	45,800	17,100	4,000	5,100
51–55.....	53	19,100	5,600	2,000	3,400
56 and over....	59	14,500	700	500	0
Total.....		$427,200	$452,100	$71,500	$49,200

Table I is the combined result of the analysis of the distribution of insurance in two young companies. In preparing this table, ten, fifteen, twenty-five and thirty payment life policies were combined with twenty payment life policies; ten, fifteen, twenty-five and thirty year endowment policies were combined with twenty year endowment policies; and five, ten and fifteen year term policies were combined with twenty year term policies.

TABLE II.

Ordinary Life.

Average Net Premium $9.90 First Year, $23.99 Renewal.
Average per $1,000 of Insurance.

Policy Year.	Terminal Reserve.	Mean Reserve.	Net Expected Mortality (American).	Net Expected Mortality (AM Select).
1.....	0	$ 4.95	$10.24	$ 4.18
2.....	$ 14.46	19.23	10.37	5.71
3.....	29.29	33.87	10.51	6.23
4.....	44.48	48.88	10.67	6.63
5.....	60.03	64.25	10.84	7.25
6.....	75.93	79.98	11.03	8.07
7.....	92.16	96.04	11.25	8.43
8.....	108.73	112.44	11.48	8.79
9.....	125.63	129.18	11.74	9.19
10.....	142.84	146.23	12.03	9.62
11.....	160.32	163.58	12.34	10.07
12.....	178.09	181.20	12.67	10.55
13.....	196.18	199.13	13.04	11.05
14.....	214.38	217.28	13.43	11.59
15.....	232.87	235.62	13.84	12.15
16.....	251.64	254.25	14.28	12.72
17.....	270.44	273.04	14.75	13.33
18.....	289.50	291.97	15.25	13.96
19.....	308.67	311.08	15.79	14.60
20.....	327.96	330.31	16.34	15.26

Twenty Payment Life.

Average Net Premium $8.55 First Year, $27.20 Renewal.
Average per $1,000 of Insurance.

Policy Year.	Terminal Reserve.	Mean Reserve.	Net Expected Mortality (American).	Net Expected Mortality (AM Select).
1.....	0	$ 4.28	$8.85	$3.30
2.....	$ 19.35	23.28	8.81	4.37
3.....	39.41	42.98	8.77	4.60
4.....	60.21	63.41	8.74	4.74
5.....	81.77	84.59	8.70	4.99
6.....	104.13	106.55	8.66	5.35
7.....	127.30	129.32	8.63	5.44
8.....	151.32	152.91	8.59	5.52
9.....	176.21	177.37	8.56	5.62
10.....	202.03	202.72	8.52	5.71
11.....	228.78	229.01	8.47	5.81
12.....	256.51	256.25	8.43	5.92
13.....	285.28	284.50	8.37	6.01
14.....	315.12	313.80	8.30	6.10
15.....	346.09	344.21	8.21	6.19
16.....	378.26	375.78	8.10	6.24
17.....	411.69	408.58	7.96	6.27
18.....	446.48	442.69	7.78	6.25
19.....	482.71	478.20	7.55	6.18
20.....	520.99	515.45	7.24	6.03

TABLE II (*Continued*)

Twenty Year Endowment.

Average Net Premium $23.13 First Year, $41.69 Renewal.
Average per $1,000 of Insurance.

Policy Year.	Terminal Reserve.	Mean Reserve.	Net Expected Mortality (American).	Net Expected Mortality (AM Select).
1.....	$ 15.08	$ 19.11	$8.87	$3.38
2.....	50.00	53.39	8.71	4.43
3.....	86.36	89.03	8.54	4.61
4.....	124.17	126.11	8.37	4.70
5.....	163.45	164.66	8.18	4.88
6.....	204.38	204.76	7.97	5.13
7.....	246.91	246.49	7.76	5.09
8.....	291.15	289.88	7.52	5.04
9.....	337.26	335.05	7.25	4.97
10.....	385.23	382.09	6.96	4.87
11.....	435.26	431.09	6.63	4.75
12.....	487.36	482.16	6.27	4.59
13.....	541.68	535.37	5.85	4.38
14.....	598.42	590.90	5.37	4.12
15.....	657.75	648.93	4.80	3.78
16.....	719.72	709.58	4.15	3.33
17.....	784.73	773.07	3.37	2.77
18.....	852.85	839.64	2.44	2.05
19.....	924.49	909.52	1.34	1.15
20.....	1,000.00	983.09	0	0

Twenty Year Term.

Average Net Premium $9.88 First Year, $14.78 Renewal.
Average per $1,000 of Insurance.

Policy Year.	Terminal Reserve.	Mean Reserve.	Net Expected Mortality (American).	Net Expected Mortality (AM Select).
1.....	$ 0	$ 4.94	$10.23	$ 4.14
2.....	4.82	9.80	10.46	5.74
3.....	9.57	14.59	10.72	6.35
4.....	14.19	19.27	11.02	6.86
5.....	18.62	23.80	11.35	7.66
6.....	22.80	28.10	11.73	8.73
7.....	26.77	32.18	12.18	9.31
8.....	30.35	35.95	12.65	9.95
9.....	33.48	39.31	13.21	10.67
10.....	36.10	42.18	13.83	11.46
11.....	38.11	44.50	14.54	12.34
12.....	39.41	46.15	15.36	13.33
13.....	39.78	46.99	16.28	14.42
14.....	39.11	46.84	17.34	15.64
15.....	37.24	45.57	18.54	17.02
16.....	33.90	42.96	19.92	18.55
17.....	28.86	38.77	21.52	20.29
18.....	21.79	32.72	23.37	22.29
19.....	12.30	24.44	25.52	24.57
20.....	0	13.54	28.03	27.19

Such a grouping of the various plans and ages at entry, and the assumption that under any plan group the distribution of insurance by age at entry is constant for all years of issue, very greatly reduces the labor of computing expected profits.

In the calculation of Table II, it is assumed that the insurance in force under any of the four plans, is distributed by age at issue according to Table I, and that reserves are computed according to the American Experience Table of Mortality with 3½ per cent. interest, by the Modified Preliminary Term method, Illinois Standard.

Table II furnishes the basis for the estimation of profits after reinsurance. It is preferable, however, to compute those profits by calendar year after reinsurance; to simplify the calculation it will be assumed that the business is reinsured on January 1.

Interest Profit. The rate of interest likely to be earned upon the funds of the reinsured business can usually be fairly closely estimated. Inasmuch as the reinsured business is a closed group, the policy reserves and other funds will increase more slowly than the policy reserves and other funds of a going concern. The net rate of interest at which the funds are or can be invested when the reinsurance is effected, may therefore usually be assumed with little or no modification, as the rate of interest likely to be earned in the future upon the funds of the reinsured business.

In order to illustrate the method of estimating future interest profits, it is assumed that the net rate of interest is 5 per cent. As the valuation rate of interest is assumed to be 3½ per cent., the interest profit is 1½ per cent. of the average amount of reserve held during any calendar year. For example, the average mean reserve under ordinary life policies is $129.18 at the beginning of the tenth calendar year and $146.23 at the end of the tenth calendar year, therefore the average amount of reserve held during the tenth calendar year is $137.71, and the average interest profit during the tenth calendar year is $2.07.

Mortality Profit. The past mortality experience of the group of business under consideration is the best index of what its future mortality will be. The ratio of the actual mortality to that expected according to the American Experience Table of Mortality can usually be obtained for any year in the past; and by taking into consideration the amount of insurance that was exposed during the various policy years, a rough estimate can be made of the ratio of the actual mortality in any year of the past, to that expected ac-

cording to the American Men Select Table of Mortality. If the past mortality experience of the group of business is deemed insufficient to be used in estimating the future mortality, then consideration may be given to the geographical distribution of the business, the respective proportions of rural and urban business, the standards by which the business was selected, and the personnel of the agency force and the staff of medical examiners.

I think some allowance should also be made for increased mortality after reinsurance, due to excessive lapsation likely to be caused by the reinsurance transaction. No matter what the facts may be regarding the effect upon mortality by normal lapses and surrenders, there can hardly be any difference of opinion regarding the effect upon mortality by lapses and surrenders caused by the disturbance of the business after it has been reinsured. Such lapses and surrenders are not due to inability to pay the premium, but are deliberate. Men who know themselves to be impaired do not deliberately drop their insurance because of disapproval of the reinsurance of their policies, and men who are impaired do not drop their policies to take out new insurance in other companies.

For the purpose of illustration it is assumed that the actual mortality under all plans after reinsurance is 110 per cent. of that expected according to the American Men Select Table of Mortality. A number of the larger companies have analyzed and published their individual mortality experience during the period under observation in the American-Canadian Mortality Investigation. As their mortality was lower than that according to the American Men Select Table of Mortality, it is obvious that the mortality of some of the companies that also contributed their experience to the American-Canadian Mortality Investigation was higher than that according to the American Men Select Table of Mortality, and it is believed that it was the younger companies, less experienced in the selection of risks, that suffered a mortality in excess of the average. Business reinsured is invariably the business of a young company, usually less than ten years old. It is furthermore likely that the excessive lapsation to which reinsured business is invariably subject during the first year after reinsurance, has the effect of increasing the mortality under the insurance remaining in force. I, therefore, believe that the mortality rate I have assumed is fairly representative of the average group of reinsured business under policies of ordinary insurance.

The method of calculating expected mortality profit is illustrated. The mortality profit during the tenth calendar year is the mean between the mortality profit during the ninth policy year and the tenth policy year. Under ordinary life policies, the average actual net mortality during the ninth policy year is assumed to be $10.11, the average net expected mortality is $11.74, and the mortality profit is $1.63; and during the tenth policy year the actual net mortality is assumed to be $10.58, the expected net mortality is $12.03, and the mortality profit is $1.45; therefore the mortality profit during the tenth calendar year is the mean between $1.63 and $1.45, or $1.54 per $1,000 of insurance.

Loading. The loading under the various plans is assumed to be as follows:

Plan.	Average Loading.	Percentage of Net Premium.
Ordinary Life	$1.44	6 per cent.
20 Payment Life	$1.09	4 per cent.
20 Year Endowment	$1.67	4 per cent.
20 Year Term	$1.18	8 per cent.

Expenses. The expenses of handling reinsured business may be classified as follows:

(1) Renewal commissions payable upon premiums collected after reinsurance.
(2) Taxes on premiums.
(3) Home office expenses, and sometimes the expense of maintaining an office where the original company was located.
(4) Extraordinary expenses connected with the acquisition of the reinsured business, including the expense entailed in transferring the records to suit the requirements of the reinsuring company. Reference may also be made to the possibility of the reinsuring company being required to defend a lawsuit brought by some dissatisfied minority stockholder.

Renewal commissions and taxes on premiums may be best represented as a percentage of the premium income; and in any individual case, that percentage may be very closely estimated. The extraordinary expenses connected with the acquisition of the business may be considered as an addition to the purchase price or else as a deduction from the present value of future profits expected to be realized from the operation of the reinsured business.

The home office expenses entailed in caring for the business may be best represented as a constant charge per thousand of insurance in force. If the average size of the reinsured policy approximates the average size of the policies issued by the reinsuring company, then it may be assumed that the cost of handling the reinsured business will be at least as much per thousand dollars of insurance as the cost of handling its own business after the first premium has been paid. The cost of handling reinsured business is perhaps somewhat greater, because the records of the reinsured business must always be kept separate even if for no other reason than that the policy numbers will duplicate a section of the policy numbers of its own business, and because reinsured business requires a great deal of extra attention for a year or two to counteract the tendency toward excessive lapsation.

For the purpose of illustration, I have assumed renewal commissions to agents to be 5 per cent. for nine years, premium taxes to be 2 per cent. of the gross premiums, and home office expenses to be $2.00 a year for each thousand dollars of insurance in force.

TABLE III.

PROFITS FROM REINSURED BUSINESS EXCLUSIVE OF PROFITS FROM LAPSE AND SURRENDER.

Ordinary Life

Average per $1,000 of Insurance.

Calendar Year of Policies.	Interest Profit (1).	Mortality Profit (2).	Loading (3).	Expense (4).	Net Total (1) + (2) + (3) − (4) (5).
2	$0.18	$4.86	$1.44	$3.78	$2.70
3	.40	3.87	"	"	1.93
4	.62	3.52	"	"	1.80
5	.85	3.13	"	"	1.64
6	1.08	2.51	"	"	1.25
7	1.32	2.06	"	"	1.04
8	1.56	1.90	"	"	1.12
9	1.81	1.72	"	"	1.19
10	2.07	1.54	"	"	1.27
11	2.32	1.35	"	2.51	2.60
12	2.59	1.17	"	"	2.69
13	2.85	.98	"	"	2.76
14	3.12	.79	"	"	2.84
15	3.40	.58	"	"	2.91
16	3.67	.38	"	"	2.98
17	3.95	.19	"	"	3.07
18	4.24	−.02	"	"	3.15
19	4.52	−.19	"	"	3.26
20	4.81	−.35	"	"	3.39

TABLE III (*Continued*).

Twenty Payment Life.

Average per $1,000 of Insurance.

Calendar Year of Policies.	Interest Profit (1).	Mortality Profit (2).	Loading (3).	Expense (4).	Net Total (1) + (2) + (3) − (4) (5)
2	$0.21	$4.61	$1.09	$3.98	$1.93
3	.50	3.85	"	"	1.46
4	.80	3.62	"	"	1.53
5	1.11	3.36	"	"	1.58
6	1.43	2.99	"	"	1.53
7	1.77	2.71	"	"	1.59
8	2.12	2.58	"	"	1.81
9	2.48	2.45	"	"	2.04
10	2.85	2.30	"	"	2.26
11	3.24	2.16	"	2.57	3.92
12	3.64	1.99	"	"	4.15
13	4.06	1.83	"	"	4.41
14	4.49	1.67	"	"	4.68
15	4.94	1.49	"	"	4.95
16	5.40	1.32	"	"	5.24
17	5.88	1.14	"	"	5.54
18	6.38	.98	"	"	5.88
19	6.91	.83	"	"	6.26
20	7.45	.68	"	"	6.65

Twenty Year Endowment.

Average per $1,000 of Insurance.

Calendar Year of Policies.	Interest Profit (1).	Mortality Profit (2).	Loading. (3).	Expense. (4).	Net Total (1) + (2) + (3) − (4) (5).
2	$ 0.54	$4.49	$1.67	$5.04	$ 1.66
3	1.07	3.66	"	"	1.36
4	1.61	3.33	"	"	1.57
5	2.18	3.01	"	"	1.82
6	2.77	2.57	"	"	1.97
7	3.38	2.25	"	"	2.26
8	4.02	2.06	"	"	2.71
9	4.69	1.88	"	"	3.20
10	5.38	1.70	"	"	3.71
11	6.10	1.51	"	2.87	6.41
12	6.85	1.31	"	"	6.96
13	7.63	1.12	"	"	7.55
14	8.45	.93	"	"	8.18
15	9.30	.74	"	"	8.84
16	10.19	.56	"	"	9.55
17	11.12	.40	"	"	10.32
18	12.10	.26	"	"	11.16
19	13.12	.13	"	"	12.05
20	14.19	.03	"	"	13.02

TABLE III (*Continued*).

Twenty Year Term.

Average per $1,000 of Insurance.

Calendar Year of Policies.	Interest Profit (1).	Mortality Profit (2).	Loading. (3).	Expense. (4).	Net Total (1) + (2) + (3) − (4) (5).
2	$0.11	$4.92	$1.18	$3.12	$3.09
3	.18	3.93	"	"	2.17
4	.25	3.60	"	"	1.91
5	.32	3.20	"	"	1.58
6	.39	2.52	"	"	.97
7	.45	2.04	"	"	.55
8	.51	1.83	"	"	.40
9	.56	1.59	"	"	.21
10	.61	1.34	"	"	.01
11	.65	1.10	"	2.32	.61
12	.68	.83	"	"	.37
13	.70	.55	"	"	.11
14	.70	.28	"	"	−.16
15	.69	− .02	"	"	− .47
16	.66	− .34	"	"	− .82
17	.61	− .64	"	"	−1.17
18	.54	− .97	"	"	−1.57
19	.43	−1.32	"	"	−2.03
20	.28	−1.69	"	"	−2.55

Column (5) of Table III shows the expected profits, according to the given assumptions of interest, mortality, loading and expense, under each of the four plans of insurance during the various calendar years of the policies. For example, ordinary life policies issued in 1915, and reinsured on January 1, 1921, would produce a profit of $1.04 per thousand of insurance in force during 1921, $1.12 per thousand of insurance in force during 1922, et cetera.

Termination Rate. In order to discount these profits to the date of reinsurance, the termination rate likely to be experienced must be taken into consideration. The termination rate actually experienced in the past by the group of insurance under consideration is the best index of what the future normal termination rate will be. A knowledge of the conditions of the policies and the practices of the retiring company will also be of value in estimating the future termination rate; for instance if a large proportion of the policies are burdened with policy loans, a high lapse rate may be expected; and if high pressure methods were employed in getting the business, a high lapse rate may be expected when the second premium becomes due. Allowance should also be made for excessive lapsation for a year or two. The excessive lapsation usually experienced

when the first premium after reinsurance becomes due, is caused by the disturbance incident to the transfer of the business from one company to another; the greater such disturbance, the greater the termination rate will be.

The following termination rates are assumed for the purpose of illustration:

TERMINATION RATE AFTER REINSURANCE.

Number of Premiums Received Before Reinsurance.	First Premium Due After Reinsurance.	Second and Subsequent Premiums Due After Reinsurance.
1	40 per cent.	4½ per cent.
2	32 per cent.	4½ per cent.
3	17 per cent.	4½ per cent.
4 or more	11 per cent.	4½ per cent.

These termination rates are assumed to include terminations by death, lapse and surrender, and also changes to paid up or extended term insurance. It is not claimed that these rates are the experience of any group of reinsured business or of any combination of groups of reinsured business. The termination rates of the various companies shown on pages 77–82 are unfortunately not in the proper form to be available for these calculations; therefore, it was necessary to create a table of termination rates in a somewhat arbitrary fashion. It is believed, however, that the above termination rates roughly reflect the actual experience of the better of the various groups of reinsured business. For the sake of simplicity of calculation, the termination rate was assumed to be constant after the first premium due after reinsurance is paid. This is probably substantially true. As the mortality rate increases with the increase in duration, the constant termination rate really involves a diminishing rate of voluntary nonpayment of premium. While it is recognized that the higher the premium the lower the termination rate, the absence of data compels the assumption of the same termination rate for all plans of insurance.

Number of Years' Profits to be Discounted. Perhaps the most important question the reinsuring company is called upon to decide in connection with the price it is willing to pay for a group of business, is the number of years' profits to be anticipated in the purchase price.

The purchase price of reinsured business is usually taken from the surplus of the reinsuring company or obtained from friendly interests connected with the reinsuring company. A part of the

purchase price may be considered as the value of the agency force that is acquired. As the reinsuring company expects to ultimately realize a profit from the transaction and as it is desirable to restore the surplus or cancel the debt incurred on account of the transaction within a limited number of years, the remainder of the purchase price should be recovered within a limited number of years from the profit derived from the reinsured business. Opinions will vary regarding the number of years' profit that may be anticipated in the purchase price of reinsured business; but probably any company, which is seriously considering the acquisition of business in bulk, would be willing to anticipate profits for five years; and probably no company, that appreciates the speculative elements involved, would be disposed to anticipate profits for more than ten years.

The main problem, therefore, resolves itself into estimating the present value of the profits expected to be derived from the reinsured business within the number of years determined upon. Table IV illustrates a method of discounting profits from reinsured business. Ordinary life policies under which one premium was paid prior to reinsurance are used for the purpose of illustration.

TABLE IV.

PROCESS OF DISCOUNTING PROFITS TO DATE OF REINSURANCE.

Average per $1,000 of Insurance.

Calendar Year After Reinsurance.	Termination Rate (1).	Probability of Paying Premium Due in Year (2).	$v^{n-\frac{1}{2}}$ (3).	Discount Factor (2) × (3) (4).	Profits from Table III (5).	Discounted Value of Profits (4) × (5) (6).
1.....	40%	.6000	.9762	.5857	$2.70	$1.59
2.....	4½%	.5730	.9297	.5327	1.93	1.03
3.....	4½%	.5472	.8854	.4845	1.80	.87
4.....	4½%	.5226	.8433	.4407	1.64	.72
5.....	4½%	.4991	.8031	.4008	1.25	.50
6.....	4½%	.4766	.7649	.3646	1.04	.38
7.....	4½%	.4552	.7285	.3316	1.12	.37
8.....	4½%	.4347	.6938	.3016	1.19	.36
9.....	4½%	.4151	.6607	.2743	1.27	.35
10.....	4½%	.3964	.6293	.2495	2.60	.64

By adding the figures in column (6) we get $4.71 as the present value of five years' profits, $5.46 as the present value of seven years' profits and $6.81 as the present value of ten years' profits.

This process involves the assumption that there is no profit aside

from the surrender charge, in the calendar year of lapse under lapsed or surrendered policies; but on the other hand it involves the assumption of the continuance of profits from policies terminated by death beyond the payment of the claim to the date to which premiums are paid. The assumption, that no profits accrue under policies changed to paidup or term extended insurance aside from the surrender charge, is also involved in this process.

Profit from Lapse and Surrender. The surrender charge under ordinary life, twenty payment life and twenty year endowment policies is assumed to be as follows:

End of first policy year, 100 % of terminal reserve.
End of second policy year, 100 % of terminal reserve.
End of third policy year, 10 % of terminal reserve.
End of fourth policy year, 7½% of terminal reserve.
End of fifth policy year, 5 % of terminal reserve.
End of sixth policy year, 2½% of terminal reserve.
End of subsequent policy years, 0%.

TABLE V.

PROCESS OF COMPUTING AND DISCOUNTING PROFITS FROM LAPSE.

Average per $1,000 of Insurance.

Calendar Year After Reinsurance.	Terminal Reserve (1).	Percentage Surrender Charge (2).	Surrender Charge (1) × (2) (3).	Termination Rate (4).	Mortality Rate (5).
1	$ 0	100 %	$ 0	40 %	.005
2	14.46	100 %	14.46	4½%	.006
3	29.29	10 %	2.93	4½%	.007
4	44.48	7½%	3.34	4½%	.008
5	60.03	5 %	3.00	4½%	.009
6	75.93	2½%	1.90	4½%	.010
7	92.16	0	—	—	—

Calendar Year After Reinsurance.	Lapse Rate (4)−(5) (6).	Expected Profit (3) × (6) (7).	Discount Factor (8).	Discounted Profit (7) × (8) (9).
1	.395	0	—	—
2	.039	$0.56	.5578	$0.31
3	.038	.11	.5073	.06
4	.037	.12	.4614	.06
5	.036	.11	.4197	.05
6	.035	.07	.3817	.03
7	—	—	—	—
Discounted value of total lapse profit				$0.51

Under term policies the profit from lapses is of course the full terminal reserve.

The process of computing the profit from lapses and surrenders is illustrated by Table V, ordinary life policies under which one premium was paid prior to reinsurance being illustrated.

Table VI shows the profit from lapses and surrenders discounted to the date of reinsurance, under each of the four plans of insurance.

TABLE VI.

PRESENT VALUE OF PROFIT FROM LAPSE AND SURRENDER.

(DISCOUNTED TO THE DATE OF REINSURANCE.)

Average per $1,000 of Insurance.

Number of Premiums Paid Before Reinsurance.	Ordinary Life.	Twenty Payment Life.	Twenty Year Endowment.	20 Year Term. Discounted for		
				5 Years.	7 Years.	10 Years.
1.....	$0.51	$0.67	$ 7.43	$0.82	$1.43	$2.38
2.....	4.66	6.24	15.97	2.77	3.57	4.69
3.....	.68	.92	1.95	3.50	4.47	5.98
4.....	.47	.64	1.31	3.93	5.15	6.63
5.....	.35	.47	.96	4.72	5.98	7.42
6.....	.19	.25	.50	5.45	6.73	8.08
7.....	0	0	0	6.08	7.33	8.55
8.....	0	0	0	6.58	7.75	8.80
9.....	0	0	0	6.95	8.05	8.86
10.....	0	0	0	7.16	8.13	8.69

The profit from lapses and surrenders is negligible under ordinary life and twenty payment life policies, except where two premiums have been paid before reinsurance; likewise the profit from lapses and surrenders is negligible under twenty year endowment policies except where one or two premiums have been paid before reinsurance. It is evident that any variation there would be in actual practice in the surrender charge exacted when three or more premiums have been paid, would have but little effect upon the profits. If, however, a value be granted when only two premiums have been paid, the profit from lapse at the end of the second policy year would be materially less. Under twenty year term policies the profit from lapse is considerable; in fact it is the main source of profit under such policies.

Table VII shows the present value, on the date of reinsurance, of the total expected profits including profit from lapse and surrender, based on the assumptions:

(1) that the net effective rate of interest will be 5 per cent.,
(2) that the mortality will be 110 per cent. of that according to the American Men Select Table of Mortality,
(3) that the loading in gross premiums is as stated on page 89,
(4) that the business is subject to a renewal commission charge of 5 per cent. for nine years and to a premium tax of 2 per cent., and that home office expenses will be $2.00 per year per thousand dollars of insurance in force,
(5) that the surrender charge upon lapse or surrender is as stated on page 95, and
(6) that the termination rate will be as stated on page 93.

While only a brief description has been given of the process employed to obtain the figures appearing in Table VII, it is evident that a great deal of labor was involved in its preparation. It is, moreover, evident that to deal directly with the actual classification into all the various plans and actual ages at entry of the insurance in force in a company about to retire, would involve a prohibitory amount of work,—work which is moreover usually undertaken without assurance that the deal will be consummated. A shorter though less accurate method must usually be employed.

No great loss of accuracy is entailed by dividing the insurance in force under any plan into quinquennial age groups and by then assuming that all the insurance in any age group was issued at the central age, as was done in forming Table I. Furthermore the amount of insurance in force under limited payment life policies other than twenty payment life policies is usually so small, and the factors entering into expected profits are either so similar or else so nearly compensate each other, that no appreciable loss of accuracy is entailed by considering all limited payment life policies to be twenty payment life policies. This is also true of endowment policies, which may usually all be considered to be twenty year endowment policies; if, however, there be much insurance in force under long term endowment plans, then it would be preferable to group the long term endowment policies with the ordinary life or twenty payment life policies.

To consider all term policies to be twenty year term policies is not, however, entirely satisfactory, even where the policies are renewable. Since the terminal reserves under ten year term policies, for instance, are much less than under twenty year term policies,

TABLE VII.

PRESENT VALUE OF PROFITS FROM REINSURED NONPARTICIPATING BUSINESS.

Average per $1,000 of Insurance.

Number of Premiums Paid Before Reinsurance.	Ordinary Life.	Twenty Payment Life.	Twenty Year Endowment.	Twenty Year Term.	All Plans Combined.
Profits for Five Years Discounted to the date of Reinsurance.					
1.....	$5.22	$ 4.64	$11.48	$5.80	$ 5.43
2.....	9.02	10.49	20.83	6.97	10.43
3.....	5.44	6.33	8.77	7.42	6.18
4.....	5.06	6.77	9.75	6.85	6.26
5.....	4.58	7.05	10.71	6.42	6.23
6.....	5.20	8.35	13.15	6.75	7.27
7.....	6.11	9.86	15.88	7.20	8.56
8.....	7.30	11.72	19.36	7.51	10.17
9.....	8.58	13.72	23.07	7.67	11.90
10.....	9.97	15.88	27.07	7.67	13.75
Profits for Seven Years Discounted to the date of Reinsurance.					
1.....	$ 5.97	$ 5.82	$13.20	$6.74	$ 6.46
2.....	9.94	12.01	23.16	8.01	11.73
3.....	6.62	8.40	12.09	8.50	7.91
4.....	7.02	9.93	14.92	8.37	8.97
5.....	7.31	11.21	17.60	8.18	9.85
6.....	8.01	12.77	20.62	8.28	11.08
7.....	9.01	14.54	23.99	8.43	12.55
8.....	10.26	16.70	28.11	8.35	14.35
9.....	11.63	18.99	32.54	8.12	16.28
10.....	13.10	21.45	37.31	7.64	18.34
Profits for Ten Years Discounted to the Date of Reinsurance.					
1.....	$ 7.32	$ 8.04	$16.80	$ 7.91	$ 8.35
2.....	11.93	15.18	28.38	9.42	14.45
3.....	9.68	13.14	20.01	10.42	12.02
4.....	10.40	15.31	24.12	9.99	13.58
5.....	10.78	16.93	27.57	9.43	14.69
6.....	11.57	18.83	31.40	9.06	16.15
7.....	12.66	20.97	35.64	8.69	17.86
8.....	14.01	23.49	40.71	7.99	19.91
9.....	15.49	26.17	46.15	7.02	22.09
10.....	17.07	29.07	52.01	5.72	24.43

the profit from lapse is proportionately less, and the profit from lapse is the main source of profit under such policies. Then if the term policies be non-renewable, there can be no profit after ten years under ten year term policies. The amount of insurance under term plans is usually so small by comparison with the total, that it is, however, hardly worth while making a separate calculation for each kind of term policy. By making just one calculation for

twenty year term policies, the results can afterwards be adjusted to roughly conform to the actual facts. Let us take for example a group of ten year non-renewable term policies under which seven years' premiums were paid before reinsurance; the discounted value of three years' profits from all sources except from lapse as computed for twenty year term policies, will very closely represent the limit of those profits under ten year term policies; and a comparison of terminal reserves for durations seven to ten with the corresponding terminal reserves under twenty year term policies, will roughly indicate what proportion the profit from lapse during the last three years of the ten year term policies, bears to the discounted value of three years' profit from lapse under twenty year term policies.

Business reinsured in bulk is usually of too recent origin to include any paidup insurance other than that purchased by the cash value in the event of a default in the payment of a premium, and there is seldom much of that. There will likely be some term extended insurance. In view of the unfavorable mortality under term extended insurance, it is likely that any profit there may be in it, is negligible. It may, therefore, be assumed that there will be no profit from paidup or term extended insurance.

It is evident from an inspection of Table VII that the profit from reinsured business varies considerably under the four plans investigated, and that it varies considerably with the duration of the policies prior to reinsurance. The profit from twenty payment life policies is materially greater than the profit from ordinary life policies, at least during the premium paying period; and the profit from twenty year endowment policies is considerably greater than the profit from twenty payment life policies during the premium paying period. It should not be overlooked, however, that profits from ordinary life and twenty payment life policies will continue after profits from twenty year endowment policies cease altogether.

In order to visualize the whole of a group of reinsured business subdivided only according to the number of premiums paid before reinsurance, the column headed "All plans combined" was added to Table VII. This column was formed by adding together the following percentages of the values for the four plans.

Ordinary Life	42.72%
Twenty Payment Life	45.21%
Twenty Year Endowment	7.15%
Twenty Year Term	4.92%
Total	100.00%

These percentages represent the actual distribution of insurance in force in the two companies whose data were used in the preparation of Table I. The distribution of insurance by plan may, however, vary considerably in different companies, depending as it does so largely upon the schedule of commissions to agents and upon the deliberate preference of the company; hence this column of figures has but little practical value.

While it is primarily intended to illustrate a process by which profits from reinsured business may be estimated, it is also hoped that Table VII will be of value in cases where either the detailed classification of insurance in force cannot be conveniently obtained, or where the lack of sufficient time prohibits the making of an individual calculation.

The distribution of insurance by age at entry under ordinary life and twenty payment life policies as shown in Table I and as assumed in the calculation of Table VII, is considered to be fairly representative of the younger companies. The distribution of insurance by age at entry under twenty year endowment and twenty year term policies, as shown in Table I and as assumed in the calculation of Table VII, was, however, based upon a comparatively small amount of data, and may therefore be not at all representative. Under twenty year endowment policies, a different age distribution would but slightly affect the value of future profits, but under twenty year term policies a different age distribution might considerably affect the value of future profits. Term policies, however, usually comprise but a small percentage of the total, hence in most cases even a materially different age distribution under such policies could be ignored in practice.

It is, however, likely that in most cases one or more of the other factors entering into the calculation of expected profits from a group of reinsured business, will be materially different from those assumed in the calculation of Table VII. Tables VIII to XII are, therefore, presented. These tables show the effect of a variation in certain of the factors entering into the calculation of expected profits.

TABLE VIII.

VARIATION OF MORTALITY EQUAL TO 10 PER CENT OF AM SELECT (ADDITION TO OR SUBTRACTION FROM PROFIT SHOWN IN TABLE VII).

Average per $1,000 of Insurance.

Number of Premiums Paid Before Reinsurance.	Ordinary Life.	Twenty Payment Life.	Twenty Year Endowment.	Twenty Year Term.	All Plans Combined.
Profits for Five Years Discounted to the Date of Reinsurance.					
1.....	$1.54	$1.11	$1.11	$1.58	$1.32
5.....	3.09	1.98	1.82	3.45	2.52
10.....	3.90	2.17	1.63	4.99	3.01
Profits for Seven Years Discounted to the Date of Reinsurance.					
1.....	$2.12	$1.49	$1.46	$2.23	$1.79
5.....	4.13	2.58	2.31	4.72	3.33
10.....	5.21	2.81	1.98	6.91	3.98
Profits for Ten Years Discounted to the Date of Reinsurance.					
1.....	$2.90	$1.96	$1.87	$3.14	$2.41
5.....	5.52	3.33	2.84	6.56	4.39
10.....	6.95	3.57	2.17	9.78	5.22

TABLE IX.

IF BUSINESS IS FREE OF RENEWAL COMMISSIONS (ADDITION TO PROFIT SHOWN IN TABLE VII).

Average per $1,000 of Insurance.

Number of Premiums Paid Before Reinsurance.	Ordinary Life.	Twenty Payment Life.	Twenty Year Endowment.	Twenty Year Term.	All Plans Combined.
Profits for Five Years Discounted to the Date of Reinsurance.					
1.....	$3.10	$3.45	$5.30	$1.96	$3.36
5.....	4.61	5.11	7.87	2.90	4.99
10.....	0	0	0	0	0
Profits for Seven Years Discounted to the Date of Reinsurance.					
1.....	$3.99	$4.43	$6.82	$2.51	$4.32
5.....	4.61	5.11	7.87	2.90	4.99
10.....	0	0	0	0	0
Profits for Ten Years Discounted to the Date of Reinsurance.					
1.....	$4.72	$5.24	$8.06	$2.97	$5.11
5.....	4.61	5.11	7.87	2.90	4.99
10.....	0	0	0	0	0

TABLE X.

VARIATION OF $1 IN EXPENSE OR LOADING (ADDITION TO OR SUBTRACTION FROM PROFIT SHOWN IN TABLE VII).

Average per $1,000 of Insurance.

Number of Premiums Paid before Reinsurance.	Discounted Variation in Profit (Same for All Plans).
Profits for Five Years Discounted to the Date of Reinsurance.	
1	$2.44
5	3.63
10	3.63
Profits for Seven Years Discounted to the Date of Reinsurance.	
1	$3.14
5	4.66
10	4.66
Profits for Ten Years Discounted to the Date of Reinsurance.	
1	$3.98
5	5.88
10	5.88

TABLE XI.

ASSUMING 5½ PER CENT. INTEREST INSTEAD OF 5 PER CENT. INTEREST (ADDITION TO PROFIT SHOWN IN TABLE VII).

Average per $1,000 of Insurance.

Number of Premiums Paid Before Reinsurance.	Ordinary Life.	Twenty Payment Life.	Twenty Year Endowment.	Twenty Year Term.	All Plans Combined.
Profits for Five Years Discounted to the Date of Reinsurance.					
1.....	$0.37	$0.52	$1.08	$0.13	$0.48
5.....	1.79	2.38	4.55	.52	2.19
10.....	3.22	4.57	8.69	.69	4.10
Profits for Seven Years Discounted to the Date of Reinsurance.					
1.....	$0.70	$0.95	$1.93	$0.23	$0.87
5.....	2.53	3.41	6.52	0.71	3.13
10.....	4.40	6.29	11.98	0.88	5.62
Profits for Ten Years Discounted to the Date of Reinsurance.					
1.....	$1.19	$1.61	$3.18	$0.33	$1.48
5.....	3.61	4.93	9.43	0.93	4.50
10.....	6.03	8.71	16.54	1.14	7.76

In order to illustrate the effect of an extremely unfavorable termination rate after reinsurance, the following termination rates were

applied to the data. These termination rates were suggested by the actual experience of Company Number 10 as shown on page 81.

TERMINATION RATES ILLUSTRATING EXTREMELY UNFAVORABLE EXPERIENCE.

Number of Premiums Paid Before Reinsurance.	Premiums Due After Reinsurance.				
	1st.	2d.	3d.	4th.	5th.
1	70%	18%	10%	8%	5%
2	40%	18%	10%	8%	5%
3	25%	18%	10%	8%	5%
4 or more	18%	18%	10%	8%	5%

TABLE XII.

EFFECT OF ASSUMING EXTREMELY UNFAVORABLE TERMINATION RATE (ADDITION TO OR SUBTRACTION FROM PROFITS SHOWN IN TABLE VII).

Average per $1,000 of Insurance.

Number of Premiums Paid Before Reinsurance.	Ordinary Life.	Twenty Payment Life.	Twenty Year Endowment.	Twenty Year Term.	All Plans Combined.
Profits for Five Years Discounted to the Date of Reinsurance.					
1	$−2.33	$−1.82	$+3.25	$−2.86	$−1.72
5	−0.49	−0.92	−3.26	+4.13	−0.65
10	−2.16	−3.48	−5.95	+7.38	−2.56
Profits for Seven Years Discounted to the Date of Reinsurance.					
1	$−2.78	$−2.53	$+2.23	$−3.39	$−2.34
5	−1.29	−2.13	−3.16	+3.78	−1.55
10	−3.08	−5.11	−8.93	+7.51	−3.90
Profits for Ten Years Discounted to the Date of Reinsurance.					
1	$−3.60	$−3.91	$− 0.02	$−4.07	$−3.50
5	−2.33	−3.86	− 6.15	+3.59	−3.00
10	−4.25	−7.39	−13.33	+8.20	−5.70

Table XII does not measure the full effect of an extremely unfavorable termination rate upon the profits expected to be realized from reinsured business. It merely shows how those profits are affected thereby if all other factors including mortality remain unchanged. Such excessive lapsation cannot fail having a serious effect upon the mortality on the insurance remaining in force. If, for instance, the excessive lapsation causes a 10 per cent. increase in mortality, so that the mortality is 120 per cent. of that expected according to the American Men Select Table of Mortality, then the profits would be only about one-half of those shown in Table VII.

Table VII together with Tables VIII to XII should enable one to make a fairly good estimate of the profits to be expected from reinsured business under almost any conditions. Let us take, for example, a group of business where the mortality may be expected to be 100 per cent. of that according to the American Men Select Table of Mortality, where the net rate of interest may be assumed to be $5\frac{1}{2}$ per cent., where renewal commissions are assumed to average 3 per cent. payable during the entire premium paying period, and where the other factors are assumed to approximate those upon which the figures in Table VII were based. The discounted value of the expected profits for seven years under ordinary life policies under which five annual premiums had been paid prior to reinsurance would be as follows:

Profits on basis assumed in Table VII	$ 7.31
Variation of 10 per cent. in mortality would add	4.13
Assumption of $5\frac{1}{2}$ per cent. interest would add	2.53
Variation in renewal commission	
3 per cent of gross premium of $25.43 = $0.76 × 4.66 = $3.54	
5 per cent. of gross premium for nine years =	4.61
Add	1.07
Expected profit	$15.04

Under these conditions the profits from ordinary life policies five years in force would be double those under the conditions assumed in the calculation of Table VII.

A Method of Estimating the Value of Future Profits from Reinsured Participating Business.

In estimating what profit the reinsuring company may derive from the operation of participating business, the element of dividends to policyholders must be taken into consideration.

At first blush, it might seem that no profit can be realized from participating business, because fair treatment to policyholders would require the distribution of all profit to them. It would not be fair to contemplate reducing dividends to policyholders in order to pay the stockholders of the retiring company a price for the acquisition of participating business.

Annual Dividend Policies. An analysis of the factors entering into the computation of dividends to annual dividend policies, nev-

ertheless reveals the existence of a source of profit, at least under certain conditions.

A dividend usually consists of the sum of the loading, excess interest on the reserve, and saving in mortality, less expenses. In order to declare a dividend at the end of the first policy year, which is the usual practice, and to obtain a smooth scale of gradually increasing dividends as the policy grows older, the expense charge is usually evenly distributed over every policy year, except that under the preliminary term method of valuation an additional expense charge equal to the additional loading in the first premium, with perhaps a further allowance for mortality savings due to selection, is allocated to the first policy year. That additional loading will, in a young company, particularly in a company obliged to retire, be far from sufficient to cover the additional first year expense, because the additional expense in the first year includes not only commissions, medical fees and inspection fees, but actually includes all of the overhead expenses of the agency department, virtually all of the expenses of the home office medical and policy departments, and a good part of other executive salaries. In almost all, if not all, participating companies, where the first dividend is apportioned at the end of the first policy year, a large part of true first year expenses is charged against renewal premiums in the calculation of dividends.

Under such conditions the actual expense of handling reinsured annual dividend policies would be considerably less than the expense chargeable to the policies in the calculation of dividends. Assuming that the excess interest factor and the mortality savings factor applied in the calculation of dividends distributed by the original company, approximately represent what the reinsuring company may assume will obtain in the future, the reinsuring company may properly continue the same scale of dividends and thus get the benefit of the excess of the expense chargeable to the reinsured policies in the calculation of dividends over the actual expense incurred. That profit, which is in the expense charge applied in the dividend calculation, may be as much as two or three dollars a thousand every year during the premium paying period.

Table XIII shows the present value under any plan of insurance of such a margin of profit of $2.00 per year per thousand, assuming 5 per cent. net interest, and the same termination rate assumed in the calculation of Table VII.

TABLE XIII.

PRESENT VALUE OF A $2.00 YEARLY PROFIT IN THE EXPENSE CHARGE MADE IN THE CALCULATION OF DIVIDENDS.

Average per $1,000 of Insurance.

Number of Premiums Paid Before Reinsurance.	Profits Discounted for 5 Years.	Profits Discounted for 7 Years.	Profits Discounted for 10 Years.
1	$4.88	$6.28	$ 7.96
2	5.54	7.12	8.98
3	6.76	8.68	10.98
4	7.26	9.32	11.76
5	"	"	"
6	"	"	"
7	"	"	"
8	"	"	"
9	"	"	"
10	"	"	"

In addition to the profit in the expense charge there may also be profit from lapses and surrenders; the profit from lapses and surrenders is, however, negligible as is indicated by Table VI.

If either the rate of interest or the rate of mortality or both assumed in the calculation of dividends is materially different from what may be expected to obtain after reinsurance, or if the schedule of dividends was prepared without the use of a contribution formula, and if the reinsuring company contemplates the continuance of the same dividend schedule, then the profits expected to be realized by the reinsuring company may be estimated by the method employed in the preparation of Table VII, taking the dividends into consideration along with the other factors.

Deferred Dividend Policies. If there be any deferred dividend policies among the business to be reinsured, all profits which may have accumulated under such policies should be transferred to the reinsuring company, whether or not the original company had been setting them up as a liability. If in the determination of those accumulated profits the full first year expense had been charged against the first premium and only the true renewal expense was being charged against renewal premiums, then the reinsuring company cannot hope to fairly realize any profit from the business. If the accumuluated profit under deferred dividend policies was determined by accumulating the corresponding annual dividends, then there would be a margin of profit to the reinsuring company to the same extent as under annual dividend policies. Deferred dividend

business is, however, peculiarly subject to dissatisfaction on the part of the policyholders and even to litigation—a fact that should be taken into consideration by a company contemplating the reinsurance of such business. I therefore doubt whether a company is ever warranted in paying for the acquisition of deferred dividend business reinsured in bulk.

Conclusion.

It has been demonstrated that reinsured business usually yields the reinsuring company a profit, which, together with the value of the agency force that may be acquired, enables the reinsuring company to pay a price for the acquisition of the business. It has been demonstrated that the profit yielded by reinsured business varies considerably with the plan of insurance and with the duration of the policies; and that the profit, moreover, varies with the mortality experienced after reinsurance, with the rate of interest earned on the funds of the reinsured business, with the termination rate after reinsurance, with the loading in the premiums, with the renewal commission charge to which the business is subject, with the expense of handling the business, and with the surrender charge upon lapse or surrender. All these things must be properly considered in estimating the profit that will likely be derived from a group of reinsured business, upon which depends the price the reinsuring company can afford to pay for it.

On page 104 it is shown that under ordinary life policies five years in force on the date of reinsurance, the present value of seven years' profits is more than doubled by assuming a mortality of 100 per cent. of that expected according to the American Men Select Table of Mortality instead of 110 per cent., interest at $5\frac{1}{2}$ per cent. instead of 5 per cent., and continuous renewal commissions of 3 per cent. instead of nine renewal commissions of 5 per cent. Such a variation in profit caused by so slight a variation in mortality, interest and renewal commission assumptions is truly astonishing. It demonstrates most forcibly the value, if not the necessity, of making an exhaustive study of the group of business under consideration before fixing upon the price to be paid for it.

Abstract of Discussion of Foregoing Paper.
(WRITTEN DISCUSSION.)

MR. J. D. CRAIG:

Mr. Rydgren has presented a very interesting paper, and the method outlined of deriving the value of business reinsured in bulk will be of value to any actuary who is confronted with a similar problem. The method of computing excess interest, saving in mortality, loading and surrender charge, should be before the actuary when any proposition of similar nature is presented, but it should be emphasized that the particular percentages allowed for each item will probably vary in every transaction. The company with which I am connected has reinsured many companies, but in practically every case there was a predominant factor which determined its value. Some of the reinsured companies wished to retire from active business; some went into liquidation; several started in business, but found themselves unable to get a fair start and decided to retire. One Industrial company reinsured had a debit or weekly collection of about $50. Six companies had a debit of less than $600 and two others had debits of less than $1,000.

The determination of the value of business reinsured in bulk will depend largely upon the percentage of business continuing in force after reinsurance. If all of the business remains in force with only a normal lapse rate, the value can be reasonably determined from the experience of previous years. Unfortunately, as Mr. Rydgren points out, there is a large initial lapse immediately following reinsurance, and the effect of this is hard to determine. Practically all the features can be estimated with reasonable closeness except mortality, but an adverse withdrawal rate may eliminate the better risks and render this difficult of determination. If the reinsuring company has the confidence of the insuring public, withdrawals will be reduced to a minimum and the mortality rate least affected.

The experience which we have been able to secure has not been unfavorable. When the Pittsburgh Life was reinsured in 1917 it was optional with any policyholder whether or not the Metropolitan assumed his policy. Seventy-seven per cent. of the insurance was assumed and 89 per cent. of the reserve. Thus a large proportion of old business consented to reinsurance. Three or four months elapsed before the business was finally placed on the books of the Metropolitan, so that during the calendar year of 1917 only 2.7 per cent. of the business terminated; during the next year 18 per cent. terminated but a large part of this was on account of the reinsurance, while the natural maturities were also heavy. The mortality in the Pittsburgh Life was 92 per cent. in 1912, 80 per cent. in 1915 and 78 per cent. in 1916. In 1918, the first year after reinsurance, the mortality was 105 per cent., but too much emphasis cannot be

placed upon the figure, on account of the influenza epidemic of that year. In 1920 the mortality was 89 per cent. The business of the Washington Life showed a higher mortality in 1909, the first year after reinsurance in the Pittsburgh Life—93 per cent. against 74 per cent. in 1907, but this percentage gradually reduced, so that over a period of years it was little higher after reinsurance than before.

The chief value of business reinsured is in its effect upon the reinsuring company. In 1906 the Pittsburgh Life had $7,000,000 of insurance in force, and reinsured the Security Trust and Life Insurance Co., with $21,000,000 of insurance in force. The effect was to decrease the expense rate from 30 per cent. to 13 per cent. of the premium. On the other hand the reinsurance of the Pittsburgh Life had no value to the Metropolitan. The reinsurance was simply for the purpose of enabling the Insurance Department to liquidate the business. Although at the end of 1920 the Metropolitan had accumulated a surplus in excess of $1,500.000, inasmuch as this surplus is to be returned to the policyholders of the Pittsburgh Company it is held as a liability by the Metropolitan.

While the methods outlined by Mr. Rydgren permit of an actuarial determination of the value of the business, it is probably rarely used, as the reasons for the desire to sell on the part of the reinsured company combined with the desire for the business on the part of the reinsuring company will be the chief factor in determining the price paid.

The tables following will show the termination rate after reinsurance in three companies actually reinsured. Allowance must be made in the first two groups for the fact that the major portion of the business was old business issued upon the deferred dividend plan with the tontine periods practically completed, and with no dividend or very small dividends being paid and the natural maturities were taking place. The tables show the amount of insurance involved.

TERMINATION RATE AFTER REINSURANCE.

I.

Amount Reinsured, $21,000,000.

Year.	Terminations.
(3½ mos.)	10.6%
1st	23.7
2d	11.8
3d	9.1
4th	7.6
5th	7.5
6th	7.3
7th	6.6
8th	7.3
9th	10.7
10th	10.9

II.

Amount Reinsured, $55,000,000.

Year.	Terminations.
1st	10.3%
2d	12.2
3d	9.8
4th	8.3
5th	7.8
6th	8.0
7th	7.5
8th	8.3
9th	8.2

III.

Amount Reinsured, $86,000,000.

Year.	Terminations.
(7½ mos.)	2.7%
1st	18.0
2d	8.2
3d	6.4

MORTALITY EXPERIENCE BEFORE AND AFTER REINSURANCE (AMERICAN TABLE).

I.

Before Reinsurance—In Bulk.

Year.	Ratio Actual to Expected by Amer. Table.
1903	99.5%
1904	121.9
1905	120.1
*1906	——

After Reinsurance.

1907	126.5%
1908	121.6
1909	102.7
1910	117.0
1911	107.0
1912	138.0
1913	111.6
1914	114.7
1915	140.9
1916	110.8

* Figures not available—business reinsured September 15, 1906.

II.

Before Reinsurance.

Year.	Ratio Actual to Expected by Amer. Table.
1904	86.7%
1905	92.6
1906	79.3
1907	74.3
*1908	86.7

After Reinsurance.

1909	93.3%
1910	91.6
1911	79.2
1912	98.1
1913	89.5
1914	85.8
1915	95.9
1916	89.7

* Reinsured December 31, 1908.

III.

Before Reinsurance.

Year.	Ratio Actual to Expected by Amer. Table.
1912	92.7%
1913	81.9
1914	71.3
1915	79.7
*1916	78.0

After Reinsurance.

1917	104.5%
1918	105.1
1919	97.6
1920	89.0

* Reinsured May 7, 1917.

MR. J. B. MACLEAN:

The subject dealt with in Mr. Rydgren's paper is one which has been singularly neglected from an actuarial point of view, a surprising thing in view of its very considerable interest and importance. The author is, consequently, deserving of our best thanks not only for having thrown light where, for many of us, there was much darkness, but for the very great pains he has taken to deal with the subject in such an interesting, thorough and practical manner.

Mr. Rydgren refers at the outset to the importance of the termin-

ation rate and gives tables showing actual experience as to termination following reinsurance. Although these tables no doubt justify his conclusion that the rate for the first few years will be above the normal, they give, of course, no guide as to what may be expected in any particular case. The rate of termination will depend *inter alia* on the age of the business, the relative standing of the two companies and the efforts made by the reinsuring company to prevent excessive lapse, and in very favorable circumstances the termination rate might be normal.

The general method of estimating the value of the profits expected to be derived from the reinsured business forms the principal and most interesting part of the paper. I confess that the processes described by the author remind me of an expression used by an eminent actuary in describing some tables based on composite material, and which he referred to as a "delicate mosaic." I can not help thinking that where there are so many subscribing elements each involving a greater or lesser degree of assumption and approximation the final "grand total" may be far enough from the truth, a feeling which is strengthened by the illustration given in the paper itself showing the effect of comparatively moderate variations in the basic assumptions. Moreover where there is some question as to whether these calculated profits are to be discounted for five years, seven years or ten years any refinements used in the preliminary parts of the calculation must be entirely lost sight of and the final result can only have an approximate significance. It is not clear that the discounting of profits for the entire duration of the policy should be considered as speculative, nor does any reason appear for adopting any specified term of years rather than the whole duration of the policy.

An alternative course for estimating a very considerable part of the whole profits is provided by a form of Gross Premium valuation. If a valuation is made on a "true" basis throughout, *i.e.*, as to mortality, interest and premium actually receivable, the difference between the liability so brought out and the actual reserve that must be set up by the reinsuring company (not necessarily the same amount as that held by the retiring company) increased by the present value on the "true" basis of difference between the "true" and valuation premiums will represent the "price" paid for the expected profits from interest, mortality and net loading, or, in other words, will be the present value of such future profits. This was demonstrated twenty-five years ago by Mr. G. J. Lidstone (see *J.I.A.*, XXXII).

The complications which would ensue by the introduction of the elements of lapse and surrender are too great to be overcome practically and the method is probably not suitable for the determination of these profits. Using Mr. Lidstone's notation, the expression for the present value of future profits from interest, mortality and

excess loading is $R - R'' + (P'' - P)$ a'' where R and P are the Reserve and Net Premium respectively on the valuation basis to be set up, while R'' is the reserve based on true interest and mortality and P'' is the gross premium less expenses. In making the calculations it will be sufficient to classify the policies into Life, Endowment and Term, grouping the first by present age and quinquennial age groups and the endowment and term policies by number of years to maturity or expiry and using average ages. This would mean the calculation at special interest and mortality rates of only a small number of functions which could be done by some approximate method, the sums insured and premiums being valued separately.

Mr. Rydgren refers very shortly to the question of the purchase of participating business, pointing out that on the assumption of continued dividends there is still a source of profit in the excess of the expense margin allowed for in the dividend scale over actual renewal expense and also a slight possible profit from lapses and surrenders. It seems equitable that such profit should go to the reinsuring company and not to the policies purchased, but it is not so clear that any account should be taken of it in determining the purchase price of the business since the group cannot be considered as a closed one when it is made part of a going concern. Unless, therefore, some proportion or part of the profit from such participating business is to be retained by the reinsuring company for its own benefit I should think that the only element in determining the price of annual dividend business is that of connection and good will.

In the case of deferred dividend policies the reinsuring company must decide upon what principles such dividends are to be calculated and add the proper dividend accumulations or an estimate thereof to the amount of the reserve. The question of profit will depend on similar considerations to those applicable to annual dividend business.

In conclusion I desire to express again my appreciation of this very interesting and valable paper and to say that I am sure it will be welcomed by many actuaries to whom practically no information on the subject has been available.

MR. E. M. BLEHL:

The paper by Mr. Rydgren covers comprehensively an interesting subject. I only wish to add a few practical suggestions to those already expressed.

The value of business reinsured depends on the profits which may be made out of it, the increase in volume of insurance in force, the additions which may be obtained to the agency force, and not the least important, the service which may be given to the policyholders.

This value depends in great measure on the manner in which the

reinsurance is effected, which, therefore, should be given prime consideration. Reinsurance may be assigned: (*a*) by the transfer merely of the policy obligations, together with appropriate funds to cover all reserve liabilities; or (*b*) by the purchase of stock control of a company, in which case the entire business is included.

The last method is somewhat speculative in character and there are many difficulties in the way of its successful consummation for the following reasons.

Reinsurance is generally decided on after a company has fallen into financial difficulties. It is likely, therefore, that on close examination there will be found hidden obligations, such as deferred dividend liabilities, reserve liabilities which should have been put up for guaranteed dividends, or similar items.

There may be suits threatened by policyholders, claimants and agents which would be brought to a climax in event of transfer of the business, because liquidation would necessitate immediate action by such claimants in order to protect their equities. Moreover unless the company is insolvent, and a receiver has been ordered by the court to reinsure the insurance in force, difficulty may arise from objection by any stockholder.

We must realize that unscrupulous persons have procured control of insurance companies, not for the purpose of continuing them in business, but for improper exploitation; there is, therefore, a sense of reprehensibility when strangers come in and purchase stock for the purpose of liquidating a company.

A further obstacle consists of legal decisions against bulk reinsurance without the consent of the policyholders, some of which have accorded to policyholders the return of all premiums theretofore paid if the insured declines to pay any further premiums and insists on withdrawing.

Not only may the liabilities of such a company be undervalued, but its assets may be overvalued. Assets and liabilities assume different aspects on liquidation, when forced valuations are put on them, than they have in a concern which hopes to continue business. Thus we find many mortgages on which payments are in default, and there have been companies with scores of farm mortgages on which no interest had been paid for years and which could be foreclosed only at a loss. Real estate taken over on foreclosed mortgages may be held at prices higher than the market. Bank deposits may have been made in banks which have become insolvent. Bonds may have depreciated greatly under their cost price.

Thus it is seen that the greatest care should be exercised in the purchase of the stock of a company, as the true valuation of the assets and liabilities may show considerable variation from the books, and additional liabilities will in all probability ultimately arise which are not reflected at all in the accounts. Poor assets might easily turn what may be calculated as a theoretical profit into serious financial loss.

In other words, reinsurance is not effected of a well-managed successful company, but usually, not always, it is of a moribund concern that has been struggling along for years, during which period it has been bolstering its assets and minimizing and concealing its liabilities.

To eliminate some of the speculative features of reinsurance obtained by the purchase of a company's stock, merely the business could be transferred to company B, and company A would remain in existence for a short time in order to liquidate the remaining assets, to take care of the liabilities other than policy obligations, and to wind up the company at its leisure. By such an arrangement many of the problems are solved, the value of the business reinsured may be more closely determined and equity more honorably served.

The equitable consideration for transfer of the business would depend on a calculation which approximates the acquisition costs plus such reasonable overhead expense as is normally experienced by company B. That is, company A has incurred certain expenses in which company B may participate in part, but the acquisition expenses for company B should not be as great as for company A, because:

1. Company A has been spending too much for its business, which is the prime necessity for its reinsurance.

2. The business to be transferred is not new and the benefits of selection have to a certain extent been exhausted.

3. For the purpose of making good part of the acquisition expenses, it is the general practice among companies to defer the granting of surrender values until three years' premiums shall have been paid. But as probably the greater portion of business reinsured would not be in its first or second year, and surrender values would in most cases be available, the savings from surrenders would not equal such savings as usually arise on new business.

4. There is an increased tendency to lapsation which, theoretically at least, will be more marked among the unimpaired risks; therefore, the mortality is likely to increase considerably over what company A itself has theretofore been experiencing.

For these reasons the acquisition expenses should be limited to a proportion of the normal costs. A fair approximation would probably be one half those usually experienced by company B for the first year. The best manner in which this could be paid would be in the form of commissions as the business renews, there being a reduced first year's commission during the first year of the reinsurance, and normal renewals thereafter subject to deductions for agents' commissions which must be paid.

Such an arrangement as proposed would be equitable both to stockholder and policyholder. The original stockholders failed in their effort and should be made to bear the brunt of the loss. It is not fair to pass it on to the policyholder; neither is it fair for

a new company to assume reinsurance at such a great cost as to compel that company to adopt stringent measures in order to avoid a loss.

This course is not always followed, however, and there have been known cases of reinsurance where sums have been expended not justified from any viewpoint. This is wrong. The interests to be served first are those of the policyholder, and it is not difficult to find companies which are willing to step in and assume the risks of a concern going out of business, giving full credit for every dollar of policy equity turned over to them. My personal opinion is that State insurance authorities should intervene when extravagant prices are offered for reinsurance, especially when the policies are on participating plans, for in those cases, particularly, policyholders are sure to suffer.

(ORAL DISCUSSION.)

MR. ARTHUR B. WOOD:

As I have had only a few minutes to glance through the paper, I am not prepared to present a formal discussion. I would like, however, to emphasize the point brought out by Mr. Craig, that as each company has its own peculiar features, it is impossible to establish a price applicable to every company of a particular size and with a particular distribution of business. Mr. Rydgren's paper is very interesting and will serve as a guide to the methods by which the value of the business of any company which it is proposed to reassure may be ascertained.

Another point mentioned by Mr. Craig which I would also like to emphasize is the importance of not being too optimistic in regard to the probable future profit from mortality. Mr. Rydgren has presented a number of tables to show the effect of variations in the assumptions on which the probable value of the business is ascertained. In his calculations of the discounted value of the probable profits, he has assumed the future mortality to be 110 per cent. of the American Men Select Table. Offhand, I would consider that too favorable a rate of mortality to expect. The importance of not being too sanguine in this regard is apparent from the tables, which show the effect of assuming different mortality rates. For instance, if the calculations are made on the basis of 120 per cent. instead of 110 per cent. of the American Men Table, the effect will be practically to cut in two the total discounted value of the business. Because of the adverse selection produced at the outset and during the early months after such a reassurance has been effected, I would expect a considerably higher mortality than 110 per cent. of the American Men Select during the first few years after the reassurance, which rate would gradually decrease and ultimately become about 110 per cent. If the calculations were made on such

an assumption, the value of the business would be very materially reduced.

Another point which I would like to refer to is the calculation of the probable gain from surrenders. Mr. Rydgren has based his calculations on the assumption that the full reserve by the Illinois standard is held. It should be remembered that after such a reassurance has been effected there will invariably be an impairment of reserve. Consequently the theoretical surrender charge is not realized when a policy goes off the books. As a matter of fact, one can well imagine a case where the surrender charge on the basis of the Illinois standard or some other liberal valuation basis would actually be less than the deficiency in the reserve, and under such a condition the policies going off the books during the first few years would represent a loss rather than a profit.

MR. ROBERT HENDERSON:

In our company we have not had occasion to consider this question for many years. We did in the past reinsure a little business, and it has emphasized in my mind the importance to a company of care in reinsuring participating business. It is very easy to be liberal in taking over such business. I think that a company reinsuring a block of participating business, if it is itself in a prosperous condition, will usually find that it either has to discriminate (or make an appearance of discrimination) against reinsured business or else pay to it more than it is earning.

(AUTHOR'S REVIEW OF DISCUSSION.)

MR. A. A. RYDGREN:

I think we are indebted to Mr. Craig for the data he has given us relating to mortality after reinsurance. I have been able to secure similar data of only one company, where the actual mortality in 1920 was 75 per cent. of the expected according to the American Men Select Table of mortality, and that was in the second calendar year after reinsurance.

Mr. Wood has expressed the opinion that 110 per cent. of the American Men Select Table is too low a mortality to expect under the average reinsured business. In selecting that value I had in mind both the adverse effect of excessive terminations after reinsurance and the belief that the mortality among the smaller companies, especially those obliged to retire, is higher than the average of all companies; but, on the other hand, I also had in mind the improvement in mortality during the past ten years, an improvement which is only partially reflected in the American Men Select Table. The mortality I selected to represent the average group of reinsured business, namely, 110 per cent. of the American Men Select Mortality Table, is, however, merely my own judgment and

is unsupported by any facts. It can not be emphasized too strongly that in applying the suggested method of estimating profits to any particular group of reinsured business the individual characteristic of that group of business in regards to mortality and to the other factors as well should be carefully analyzed.

In the galley proofs distributed before the meeting a considerable part of the paragraph referring to the number of years' profits to be discounted was omitted by the printer. Mr. Maclean has raised the question why profits should be discounted for a limited number of years rather than for the whole duration of the policies. Some of the factors entering into the estimate of future profits, particularly mortality and interest, are impossible to forecast with any degree of accuracy for as long a period as the whole duration of a group of policies, hence the assumption that a particular mortality rate and interest rate will prevail for five or ten years is likely to be more nearly realized than that a particular mortality rate and interest rate will prevail over the whole duration of a group of policies. This, combined with the fact that the reinsuring company usually desires to profit from the transaction, and that in many cases the reinsuring company commits itself to the liquidation of the cost of the business within a limited number of years, suggests the limitation of the number of years' profit to be anticipated in the purchase price as a practical solution of a difficult problem. The exact number of years' profits the reinsuring company is willing to anticipate will have an important bearing on the price it is willing to pay; but it can not be over-emphasized that there is a danger in anticipating profits for too long a period of years, because the reinsuring company depends upon the profits accruing after the expiration of that term of years as a safeguard against an experience more unfavorable than anticipated and for its own profit in compensation for the service it renders in taking over the business.

Mr. Blehl has indicated some of the speculative hazards the reinsuring company is exposed to in buying the capital stock or the insurance, and he has suggested an alternative plan of taking over the business of a retiring company. While Mr. Blehl's plan commends itself to the reinsuring company, I believe that it would not be considered by the stockholders of the retiring company as satisfactory as either of the two methods usually employed, and that where a number of companies are competing for the business, the company offering the highest cash price for the insurance or for the stock is apt to get the business.

Mr. Wood has raised a point that perhaps should be more clearly explained. In the calculation of the profit from lapse and surrender it is assumed that the full reserve according to the Illinois Standard is set up under reinsured policies, and that the excess of the reserve over the amount of assets actually acquired by the rein-

suring company is regarded as the price paid for the business. As Mr. Wood remarked, lapses may cause a loss to the reinsuring company because the surrender charge may be less than the price paid for the lapsed policies. That lapsed policies actually cause loss to the reinsuring company is clearly illustrated in Table XII, where it is shown that if the termination rate be increased and other factors remain the same the profits are materially diminished, notwithstanding the greater profit from lapse and surrender.

I wish to reiterate a point that has been emphasized in the discussions, namely, that the present value of estimated profits shown in Table VII will probably not obtain for any particular group of business, but that an individual calculation should be made of each group under consideration, bringing into the calculation the individual characteristics of the group.

In conclusion, I wish to thank those who have given us the benefit of their thought and experience in the discussion of this paper.

Life Insurance Without Medical Examination.

BY

D. E. KILGOUR.

There is perhaps no proposition which, to the average insurance man, would seem so fundamentally heterodox as that Life Insurance could be satisfactorily conducted without the aid of the medical examiner. Yet the medical examiner was not always with us. In fact, in point of time he is a modern rather than an ancient adjunct of our business and it may be pertinent now to enquire exactly to what extent he has justified himself and whether we have arrived at a point where we can partially or wholly dispense with his services.

In introducing this subject I wish at the outset to disclaim any desire to appropriate a subject with which others are obviously in a better position to deal. The subject has been more or less a live one in Canada and we are already indebted to Mr. Reid of the London Life for a very interesting presentation of it before the Insurance Institute of Toronto. I should gladly have deferred to him on this occasion and can only express the hope that he may yet contribute something to our Society on this important and, at present, timely subject.

So far as I am aware, no experience has been published from which definite conclusions can be drawn as to the value of medical examinations in life insurance. We undoubtedly surmise that the medical examination is an advantage but the measure of that advantage we do not know nor are we certain that we cannot substitute other methods of selection which may prove adequate. The fact of the matter is that the present day medical examination is an evolution, that in the process of evolution we have perhaps gone to an extreme and that, in the reaction which now seems to be setting in in certain quarters much that has been gained may be needlessly lost. The object of this enquiry is to direct attention to fundamental principles and more particularly to examine in the light of those principles, the wisdom or expedience of accepting risks without medical examination.

Historically, this subject is not without interest. "Life Insurance," says Mr. Nicoll in his classic paper to the Faculty of Actuaries in 1904, "may, in a sense, be said to date from the founding of the Amicable Society in the year 1705, although it is necessary to bear in mind that, for a good few years after that date, the business of that society was conducted simply on the principle of a mortuary tontine. It was desired at the first to enroll 2,000 members in all. Amongst the representatives of those who died in the first year, one-sixth of the total contributions was to be divided; in the second year, if the full number of members was enrolled, £4,000 was to be divided; in the third £6,000; in the fourth £8,000; and in the fifth £10,000; and so on forever afterwards, with a proportionate reduction if the full number of members was not enrolled. It will be seen, therefore, that the full number of deaths in any year did not affect the society, but only the representatives of those members who died each year. One result of this, however, was that each member had a direct interest in recommending only healthy lives for membership. No medical examination, or even a reference to a medical man, was required or thought of in these early days for admission into the Amicable Society. The bye-laws, however, enacted that persons living in London, or within fifteen miles of that city should appear in person before the court of directors, or before three or more of their number, and should then voluntarily upon oath—or, being a Quaker, upon solemn affirmation—declare that, to the best of his or her belief, he or she was in good health, and not subject to any particular illness tending to shorten life, and make answers to such other questions as might be put by the directors. If the life to be proposed resided at a greater distance than fifteen miles, a declaration in writing, in the form prescribed by the statute, 5 and 6 William IV., c. 62, and taken and subscribed before some justice of the peace for the place in which he resided, had to be transmitted to the directors stating his age, and that to the best of his belief, he was, and for six months last past had been, in good health, and not subject to any particular illness tending to shorten life."

In 1762, with the founding of the Equitable Society, the application form required "a reference to two persons of good repute (one if possible of the medical profession)," to ascertain the present and general state of health of the life to be assured. In 1765, the Equitable charged an increase in rates for persons not appearing before the Board. Quoting Walford's History of Life Insurance to the

effect that personal examinations probably arose with a proprietary office early in the nineteenth century, Mr. Nicoll expressed the opinion that it was well into the century before medical examinations became general with the offices. It was not until 1859 that the Equitable appointed a regular medical examiner. From about the year 1850 onwards the medical forms were continually added to and the medical examiner became entrenched in relation to life insurance. It is interesting to observe here, especially having in mind the more complete and exacting medical forms of American companies, that the elaboration of the British forms brought out early protests from both the medical examiners and the actuaries. Dr. Horder complained before the British Medical Association in 1898 about the large number of questions required to be answered in the medical reports and as early as 1886 Mr. James Chisholm stated before the Institute of Actuaries that, "with the addition of a statement of the family history we might accept lives coming to us under the same conditions as surrounded and safeguarded those early proposals for life insurance without the necessity even of medical examination."

One result of the increasing disapproval of medical requirements was that in 1890 certain schemes were introduced involving the entire elimination of the medical examinations. Thus it may be noted that practically all the Life Insurance offices had been accustomed to granting without medical examination, insurance on the lives of members of the Royal Family and of certain members of the British nobility. Several offices also had for many years plans for insuring the members of their staff without examination. The Government Insurance Department granted without medical examination assurances for sums not exceeding £25 with limitations as to payment in the earlier periods after issue.

In 1890 an English office put into effect what was probably the first plan to grant insurance to the public without medical examination. Under that plan, applicants who did not wish to submit to a medical examination but who were prepared to make a declaration of health before one of the company's officers were required to pay the Ordinary Life Participating premium for the first five years of a policy's duration; within the five years the premiums with interest at 5 per cent. alone were returnable. At the end of five years the policy became a Participating Endowment policy payable at the end of fifteen years or at previous death. The whole scheme apparently

proved unattractive and in 1900 was recast so that policies could be granted at the outset on the regular plans with limitation, however, as to the benefits in the earlier periods. The amount payable in the first year upon death was to be one-third of the sum assured, two-thirds of the sum assured in the second year and the full amount subsequently or upon death from accident at any time. No assignment was allowed of policies for less than £500 which had been less than two years in force.

In 1891 a Scottish office issued Double Endowment policies without medical examination while another Scottish office issued Deferred Annuity or Deferred Assurance contracts.

From the period noted until the present time both English and Scottish offices have been granting assurances without medical examination. As I write I have before me a number of the prospectuses issued by these companies. I cannot find that there has been any material innovation or any substantial change made in the plans effected during the past twenty-five or thirty years. So far as I am aware there have been no results furnished of the mortality experienced in the purely "Non-Medical" sections of the business. In the prospectus of one of the important British offices the following statement is made: "The scheme to furnish insurance without medical examination was a bold attempt to break down the most formidable of the barriers which in the nineteenth century kept the public outside the Life offices, and the experiment has been abundantly justified by results. At first sight it might appear that the Office was running much risk, but it was only after careful consideration of life assurance history and experience that the scheme was inaugurated. The test of time has proved that the innovation was as sound as it was original. On the occasion of the centenary meeting of the Office in March, 1910, the Chairman mentioned that there were 10,000 'Non-Medical' policies in force, and he went on to say that the death rate among those who had taken policies under this system was extraordinarily light, providing that the Office is running no undue risk. Since then, the success of this system of Assurance has been maintained and after allowing for the War claims the mortality experience is still remarkably favorable." Quoting further from the prospectus we find: "In view of the favorable experience of the Office and the strong position disclosed by the quinquennial investigation into its financial position at the end of 1911, the Managers felt justified in increasing the benefits offered in re-

spect of 'Non-Medical' policies. The ordinary rates of premium are charged, and policies effected without medical examination receive the same benefits and advantages as those effected with medical examination, subject only to two very reasonable provisions. The first is that one-third only of the sum assured is secured if the death of the life assured occur during the first three months from the date of the commencement of the assurance, two-thirds if the death occur during the second three months and the full amount on a claim occurring thereafter. If, however, death occur from accident during the first six months the full sum assured is secured. The second provision is to the effect that the policy shall not be assigned, or otherwise dealt with, during the first two years. The system of Life Assurance without Medical Examination was devised with the object of encouraging thrift and, while the policyholder has of course full power to dispose of the sum assured by will, it would be contrary to the spirit of the scheme to allow assurances to be effected in connection with loan transactions."

In view of the decision of some Canadian companies to grant the full insurance from the outset, it is interesting to note that there is a prominent red ink endorsement over the section of the prospectus furnishing restrictions as follows: "Restrictions withdrawn, February, 1921." Presumably, therefore, this office is putting into effect insurance from the date of issue. The statement is made that their bonuses are paid quinquennially but it is not affirmed that they are the same as those granted to examined lives. In passing, it may be observed that the form used for "without medical examination" cases of the Canadian companies is much more elaborate and exhaustive than the application form of the company referred to. Copies of these forms are appended hereto.

While "Non-Medical" business has never been considered seriously in America it is to be observed that some of our large Industrial companies have been conducting for some time what is known as their intermediate business (amounts up to $500) on this basis. I am not aware that any information has been published as to their experience in this class of business but the statement has been made by their officials that the business has been proven satisfactory. An official informed me that he considered that the crux of the whole matter lay in the close supervision and the control they had over their agency forces and he doubted very much if they could obtain as satisfactory results in their ordinary business or if other com-

panies could obtain a corresponding selection through the channels of their regular agency forces. It was indispensable that the agents on whom they necessarily depended so much for their facts in connection with the "Non-Medical" business should have a high sense of honor and he could recall among fifteen hundred agents only six who had violated the confidence placed in them.

In Canada the question of dispensing with the medical examination for smaller amounts has been seriously considered for some time and already four companies have inaugurated the system for amounts up to $1,000. There has also been a local company operating under a Provincial license for some time doing business without medical examination. The decision to proceed with this kind of insurance was hastened by the agitation among a number of the Medical Associations for increased medical fees. The four companies noted are operating on practically the same basis and are using very similar application blanks. A fairly complete family and personal history is called for, in fact practically all those questions, included in the ordinary medical reports, which do not demand a clinical observation or professional opinion. Insurances are issued on the same terms for amounts of $1,000 and under to both men and women. In each case a Mercantile report is called for and a scheme is now on foot to establish a central bureau for the purposes of informing the contributing companies the names of applicants applying for additional "Non-Medical" insurance. By this means much of the personal adverse selection is hoped to be avoided. I regret that sufficient time has not elapsed to furnish the Society with some information as to the success of the operation of these companies. While the executive officers generally regard the business as satisfactory, one medical officer volunteered the information that there appeared to be an alarming number of misstatements in the "Non-Medical" applications. I had occasion to look over a few days' business of one company and as far as superficial observations went, the class of the business, with one or two exceptions, seemed to be normal.

I have taken occasion to enquire through a number of agents and others in touch with the business and from my knowledge of the situation I do not believe that there has been any insistent or general demand from the agents throughout the country for their companies to conduct the "Non-Medical" business. Some have expressed the fear that it would result in the reduction of the average

amount of an application. In fact many agents make a point of endeavoring to raise the amount of the application at the time of the medical examination and claim considerable success in doing so. I have been told by an official of an Underwriters' Association that the agents representing the "Non-Medical" companies are by no means a unit in approving of the system and that they are not finding it working out as satisfactorily as they had expected. However, on this point I would hesitate to express any opinion. The representatives of these companies will be able to furnish authentic information and possibly will have some facts to give us at this meeting.

Enough, however, has already been indicated to justify the consideration of this question in its larger aspects. As it exists to-day the purposes of the medical examination may be presumed to be: (1) the elimination of persons who know that they are medically unfit and who desire to defraud the company; (2) the elimination of persons who are ignorant of their medical unfitness but who nevertheless are below the standard of acceptance; (3) the appraisement of sub-standard risks in terms of standard. If Life Insurance were purely an eleemosynary institution we should be content to let it function on the broadest possible lines. The good risks would carry the bad risks and ordinary lay selection would be sufficient to obtain an average death rate within the limits of the tables used. The application of competitive methods, however, compels companies whether they desire it or not to apply the acid test of business: "Does it pay?"

Let us for a moment consider the prospective clientele of life insurance companies. It is composed of men and women of varying expectancies of life whose deaths are productive of monetary losses and in whose lives there exists insurable interest to the extent of those prospective losses. There are therefore few lives not entitled to insurance coverage and the extent to which an office can grant this is the measure of its usefulness. A survey of any representative body of lives is therefore a survey of the very lives with whom a Life Office may expect to do business.

In an article of Dr. Fisk, Medical Director of the Life Extension Institute, appearing in the *Journal of the American Medical Association,* he states: "In the examination of a large group of supposedly healthy persons busy at their work, the Life Extension Institute found practically all showing some form of impairment and more than 50 per cent. in need of surgical attention." This finding

led to the forecast that among the population of military age, nineteen to forty-five, at least 50 per cent. would be found unfit for military service even under the relaxed war conditions. Dr. Fisk then examined the result of 8,875 men called in before local boards in Detroit, Brooklyn and New York. Of these 7,611 were examined and 2,232 or over 29 per cent. rejected. As a matter of fact according to the figures subsequently given, we know that in the first draft of nearly 10,000,000, 2,510,706 were examined and 730,756 or 29.11 per cent. were rejected. In the second draft of nearly 10,000,000 men 3,208,446 were examined and 949,419 or 29.59 per cent. were rejected. No complete tabulation has been furnished of the rejections, but an analysis was made of some 10,000 representative cases; of these 2,224 or 21.68 per cent. were rejected for defective vision; 871 or 8.5 per cent. for defective teeth; 766 or 7.41 per cent. for hernia; 609 or 5.94 per cent. for defective ears; 602 or 5.87 per cent. for heart disease; 551 or 5.37 per cent. for tuberculosis; 565 or 5.53 per cent. for mental defects; 438 or 4.27 per cent. for venereal disease; 416 or 4.06 per cent. for under-development; and 387 or 3.77 per cent. for nervous diseases.

In connection with these figures it is important to bear in mind that there was a considerable further rejection rate. In the sixteen camps upon examination of the men sent there by the local boards, the rejection rate varied from 0.72 per cent. to 11.8 per cent., and for all the camps averaged nearly 7 per cent. We may assume, therefore, that of the men who presented themselves to the local boards for examination, about 35 per cent. were rejected as unfit for military duty. The rejection rate during the Civil War was slightly higher, but on this point we can draw no conclusions. In the case of the candidates for the United States Navy, there is a very much higher rejection rate, but as the standard of acceptance is entirely different, the examination of the figures is only of passing interest. Elsewhere Dr. Fisk expresses the opinion that between the ages twenty-one and thirty-one, 40 per cent. are unfit and between thirty-one and forty-five 60 per cent. are unfit. He claims that 60 per cent. of this sub-standard condition is preventable, that 30 per cent. is due to poor general physical condition remediable by proper nutrition, physical training and hygiene, that 30 per cent. is due to defective ears and mouths, and that 10 per cent. is due to neglected surgery.

For those who are interested in the study of general mortality sta-

tistics, which undoubtedly have an important bearing on our subject, I would direct attention to an interesting chapter in the book "How to Live" published by the Life Extension Institute. There has, as we all know, been a material diminution in the death rate from typhoid fever and tuberculosis of the lungs. On the other hand in the United States registration area there has been an actual increase from 1890 to 1915 of from 27 to 39 deaths per 10,000 living, from causes relating to heart, blood vessels and kidneys. In other countries this phenomenon does not exist. In fact there has been a diminution in the important European countries in the death rate from these causes. This increased death rate from non-acute or degenerative diseases has a special significance in connection with the question of medical examination. I am unable to give corresponding figures for Canada, but in the second volume of the American-Canadian Mortality Investigation this observation is made: "The outstanding features of this investigation were markedly greater death rates among American than among Candian men from cerebral hemorrhage and apoplexy, organic diseases of the heart, diabetes, nephritis and Bright's disease and a slightly greater death rate in the case of pneumonia."

It is to be doubted if we can draw any conclusion from the general death rates furnished in census returns. The United States Life Tables, based upon the census of 1910 and the deaths in the years 1909, 1910 and 1911, as found in the registration area, reflect higher mortality rates than are to be found in our modern insurance tables; but this we should expect. The actual death rates according to cause have some bearing in indicating the existence of a large number of medically unfit lives in the general population and further in showing the increase in deaths from organic diseases. We are aware that the relation of deaths from acute and non-acute diseases is about 31 to 54 and as we know that many of the non-acute diseases exist many years before death in the incipient stages, we must attach considerable importance to the value of medical examination.

The value of the medical examiner's opinion is given in a very interesting article by Dr. Brandreth Symonds, Chief Medical Director of the Mutual Life Insurance Company of New York. Dr. Symonds attempts to establish the value of a medical examiner's opinion. Whether he does this or merely establishes the value of ascertaining the facts by a medical examination, is another question. Commenting on the importance of an examination, Dr.

Symonds observes: "When a medical examination is made for life insurance, the duty of the medical examiner comprises at least two functions, (1) his detection of physical impairments, whether organic or functional, and (2) his ability to extract from an unwilling witness accurate knowledge of past diseases, the family history, habits, etc. For the proper exercise of both these functions a good deal of common sense is mixed with medical skill and knowledge. He knows what impairments have practically no influence on mortality, such as flat feet, cardio-respiratory murmurs, etc., and does not cumber his report with details of inconsequential trifles. He knows that apparent disturbances of function, such as persistent albumin and persistent irregularity of pulse have a bad influence on mortality, and that organic murmurs of the heart, present evidence of tuberculosis, etc., have a worse effect. This knowledge comes in part from the general prognosis learned in medicine and in part from the special information taught by life insurance companies. This latter item could be made of increasing value by a wider publicity of the papers read at the meetings of our Association and other similar organizations. As a result the medical examiner knows that certain classes of functional and organic defects are not usually acceptable for standard insurance." Dr. Symonds proceeds to correlate the percentages of "Disapproved by Medical Examiner" from the years 1893 to 1916, inclusive, with the death rate for those years experienced by the company and draws this conclusion, that as the percentage of "Disapproved by Medical Examiner" increases, the mortality ratio for that year decreases. "Frankly," he says, "this was a surprise when first noted, for the view had prevailed that an increase in the percentages of 'Disapproved by Medical Examiner' meant that a large volume of poor business had been presented to the medical examiner, and therefore it was probable that the mortality would be high." An interesting table is furnished showing the rejection rates for a number of their important offices and the inference appears to be established that a higher rejection rate has a decidedly favorable influence on the mortality.

Dr. Symonds summarizes his conclusion as follows: (1) There is a distinct correlation between the percentages of risks "Disapproved by Medical Examiner" and the mortality for the first and subsequent policy years; (2) the correlation is negative and therefore the mortality becomes smaller as the percentage of "Disap-

proved by Medical Examiner" becomes larger; (3) the correlation decreases with the duration of insurance, but shows some evidence even up to the tenth policy year; (4) the correlation is not perfect even for the first policy year, for the medical examiner is only one of many factors in selection. Furthermore, he cannot be held responsible for a certain proportion of those deaths which are due to external and acute diseases.

In order to ascertain whether any important conclusion could be drawn from the rejected business of a company, I made a study of the declinations for the year 1919 for the company with which I am connected. There was a total of 685 declined policies; of these 367 were in connection with applications of $1,000 and under, and 318 in connection with applications for over $1,000. The fact that the received applications were almost equally divided between those for amounts of $1,000 and under and those for amounts of over $1,000 would appear to establish that the declination rate in connection with smaller applications is at least as great as with the applications for larger amounts. In this particular instance it is larger. Among the declinations on applications for $1,000 and under, 105 were for circulatory conditions, 51 respiratory and 52 urinary. Corresponding to these figures in connection with applications for amounts of over $1,000 we have respectively 92, 37 and 50 declinations. The data here is of course too small to warrant any sweeping conclusion, but it establishes the fact that there is as high a declination (if not higher) in connection with applications for smaller amounts as in connection with applications for larger amounts, that from 55 per cent. to 60 per cent. of the declinations are from circulatory, respiratory and urinary causes and that these causes are slightly more influential in connection with declinations for "smaller" amounts than is the case with declinations for "larger" amounts. Leaving aside the consideration of the factor of fraud, which is of greater importance in connection with applications for large amounts, we are compelled to conclude that a medical examination is just as important a factor in connection with applications for small amounts as it is for applications of large amounts.

For reasons best known to themselves the British companies have been very reluctant to furnish information about their "Non-Medical" business. As a result we have really to go back to the Equitable experience of 1762 to 1829 for any statistics showing the incidence of mortality in a class composed largely of "Non-

Medical" cases. In the discussion of this table Mr. Nicoll quotes Mr. Manly to the effect that, because of the peculiar way in which the experience was obtained, the results were of doubtful value for comparative purposes. This table would appear to establish a high second and third year mortality and raises the question as to whether the limitation of the risk in the first year is as important as in the subsequent early years. Mr. Nicoll surmises "that the discrimination by the insured in the early days seems strongly to take the form of wishing to give a due amount of decency to their claims by deferring them past the first year at least." At this point I may observe that Mr. Nicoll's general conclusion is that "Non-Medical" risks would show a mortality of 10 per cent. to 20 per cent. over the medically examined risks. As to the accuracy of this forecast it would be futile to hazard an opinion. I am personally rather inclined to think that he has understated the excess and that unless a company should practice more than usually rigid selection in other respects it would be wiser to anticipate extra mortality of not less than 20 per cent.

Some time ago I took occasion to address a short questionnaire on this subject to a few of the members of this Society. I did so without the thought of preparing the present note and for the simple reason that the project of writing "Non-Medical" business was under consideration by the Canadian companies. It would be scarcely in place here to make use of the opinions given me more or less in confidence. The consensus of opinion, however, was distinctly adverse although the point was made that as it was impossible to write "Non-Medical" business in some of the States on account of the legislation, the subject was not a matter to which they had given much consideration. One member whose opinion I value most highly believed that the "Non-Medical" business would be satisfactory provided there were limitations placed on the risk in the early years and that the greatest care was exercised in the selection of agents. He thought also that it would be advisable to reduce the initial commission on the "Non-Medical" business. This suggestion I personally regard as impracticable. I do not see, when we place greater responsibility on the agent and when we expect more from him, that we could ask him to accept a smaller remuneration for his work. I am not certain too that unless the agent were more than human he would not feel disposed to minimize the weak points in a risk in order to compensate for his reduced emolument.

There are many noted authorities especially among Old Country actuaries who believe that the business can be conducted safely and profitably. Mr. Nicoll quoted a number in his paper and those who are disposed to obtain their views would be well advised to refer to this fountain-head of information. In the discussion on Mr. Nicoll's paper the case against the "Non-Medical" business was admirably put by Dr. Byron Bramwell and I am taking the liberty here of quoting his discussion in full:

"I am very much obliged to the Faculty for inviting me to be present this evening, and for giving me the opportunity of listening to Mr. Nicoll's most interesting paper. The subject, not only the main question—the advisability and feasibility of life assurance without medical examination—but many of the subordinate questions raised in Mr. Nicoll's paper are of great interest to medical men. The fundamental point, which seems to me to underlie all these questions, is the value of the medical examination in cases of life assurance. Mr. Nicoll will not perhaps be surprised if I take a somewhat different view as regards this from what he has done. I am strongly of opinion that in the selection of lives for assurance a medical examination is, in ordinary circumstances, essential. It is, of course, possible to frame satisfactory schemes of life assurance without medical examinations; but it seems to me that any such plan, if it is to be satisfactory and remunerative, if it is to meet the extra risks which the abolition of the medical examination must necessarily involve, must carry with it, in some form or another, a substantial extra to the ordinary rates of premium. The abolition of the medical examination necessarily, I think, involves certain extra risks. In the first place, one knows that the medical examination shows that certain persons who appear to be perfectly healthy—persons of good physique, of normal height and weight, persons whose personal and family histories, whose occupations and habits are all quite satisfactory—are the subjects of serious disease, such, for example, as aneurism, valvular heart disease, kidney disease, etc. Cases of this sort are not very numerous, but they constitute, as we all know, a certain proportion of the whole. And if any considerable number of bad lives of this kind (which can only be detected by medical examination) are admitted as first-class lives at the ordinary rates, loss must necessarily result to the assurance company. If the medical examination is abolished, an extra of some form or another must be added to the ordinary premium in order to cover this risk. Then, in the second place, as has been already pointed out by one of the previous speakers, the medical examination acts as a deterrent against fraud. Persons who know that they are bad lives or who believe that they are bad lives, and who would like to defraud the insurance companies, hesitate to present themselves to the medical examiner, knowing that their

flaws will be detected. It seems to me that the abolition of the medical examination would tend to encourage fraud, and would allow some persons who wish to impose upon the assurance company to do so. Whether fraudulent cases of this kind would be numerous or not, I do not, of course, pretend to say; but if the medical examination is abolished, an extra of some sort or another would have to be added to protect the company against this risk. I presume that there are no sufficient or satisfactory data for saying how large such an extra would require to be. Then, if we look at the persons who would be likely to select such a scheme in preference to the ordinary schemes with medical examination, we may, I think ,divide them into two classes. Firstly, persons who believe themselves to be good lives, and, secondly, persons who know that they are bad lives or who believe that they are bad lives. Now, since the rates for assurance without medical examination must necessarily be higher than the rates for assurance with medical examination, would many persons who believe they are perfectly good lives be likely to select such a scheme? Would they be willing to pay the extra, which such a mode of insurance necessitates, in order to escape the medical examination? Mr. Nicoll has given us a number of reasons why proposers object to a medical examination; they do not carry much conviction to my mind. I agree with the last speaker in thinking that the number of *bona fide* proposers who refuse to present themselves under the ordinary schemes, because they object to the medical examination, is not large. It is not, perhaps, possible to form an exact estimate on this point. If this conclusion is correct, it would suggest, either that the number of persons who would select such a scheme would not be large, or that, if the number were considerable, the majority of persons who would be likely to select such a scheme would probably be persons who either know that they are bad lives or who think that they are bad lives. With regard to the value of the medical examination, it is, I think, taking far too narrow a view of it to say that its whole object is to detect the presence of actual diseased conditions. The medical examiner, if he is a good man, is able in the course of his examination to clear up many doubtful points as to habits, previous history, family history, etc., and, quite irrespective of any actual disease, to form an estimate of the probable longevity of the proposer and of his liability to future disease, which an ordinary (non-medical) official of the company, however able and experienced, could not possibly do. Mr. Nicoll seems to me to rate the capabilities of the agents and ordinary officials far too high when he suggests that they should take the place of the medical examiner and report upon the physique and health of the proposer. Mr. Nicoll even goes so far as to suggest that they should examine the teeth and report on other minute points of that kind. Then one must remember that the medical examiner does not, or certainly should not, base his opinion of the physique and constitution of the pro-

poser merely upon the appearance of the fully-dressed individual. The proposer is, or should be, stripped to the waist. I do not wish to appear to undervalue the knowledge and experience of the ordinary officials on medical questions—my opportunities are, of course, limited, but I know that some assurance officials have a very sound and extensive knowledge of the medical questions relating to life assurance, and that, when the data, medical and other, are placed before them, they are able to give most valuable and important opinions as to the value of the life, the amount of extra required, etc. One must, of course, draw a distinction between the ordinary examiner and the head medical adviser, and between the agents and subordinate officials and the leading officials of the head office. I take it that the chief object of the medical examination is to get the data on which the opinion of the experts, as regards the value of the life, the amount of extra, etc., is to be based. The opinion of the ordinary medical examiner in regard to the amount of extra required for a damaged life is not always, of course, followed, for his experience and knowledge on difficult questions of this kind is often limited. Mr. Nicoll has referred to the early experience of the Equitable office in particular, and has concluded that the results obtained without medical examination were in the early days of life assurance as good as those which are now obtained with medical examination; but, as both of the previous speakers have pointed out, it is extremely difficult to compare the results and to draw conclusions from such data. In the early days of life assurance only the best lives came forward, and only the best lives were accepted. Now all sorts—good, bad and indifferent—come forward, and are accepted without or with an extra. It seems to me to be impossible, practically speaking, to fairly compare the results. The question seems to me to be this: If the same stringent regulations were now adopted with regard to physique, general appearance, height and weight, occupation, habits, family history, personal history, etc., which were adopted in the early days of life assurance, would we not now, when we have in addition the medical examination, get better results than, say, the Equitable did in the early days without medical examination? Many borderland cases are now accepted at ordinary rates, which would not have been looked at in the early days of life assurance. I would suggest that, instead of doing away with the medical examination, it would be better to raise the standard and not to pass proposers whose cases (either because of poor physique, doubtful family history, doubtful habits, doubtful personal history, etc.) are borderland cases, at the ordinary rates for first-class lives."

In conclusion it may be stated:

(1) That insofar as fraudulent selection is concerned the medical examination is extremely valuable if not indispensable. In smaller amounts this factor is of less importance. Nevertheless, it must

be presumed that if the medical examination should be waived this factor both with respect to small and large amounts would be of increasing importance;

(2) That the medical examiner is alone able to detect the presence of a large class of impairments affecting longevity. Other things being equal we should look for an increased mortality in the "Non-Medical" business probably not less than 20 per cent. This would much more than offset any initial saving to the company;

(3) That while from the point of view of moral hazard it would be much safer to restrict "Non-Medical" business to smaller amounts the probability is that apart from this the medical examination is as valuable in the case of smaller as in the case of larger amounts;

(4) That sub-standard business is impracticable without medical examination;

(5) That while the character of an agency force is a determining factor in the mortality of a company—perhaps the most important—it is an independent factor. Whether or not (unless the "Non-Medical" business should become general) the "Non-Medical" company would be able to attract the best agents is open to doubt;

(6) That in practice the limiting of the amount without examination, say, to $1,000, is likely to make it more difficult to persuade a wavering prospect to apply for the amount he might otherwise be induced to apply for. Many active agents obtain an increase in the application at the time of the completion of the medical examination;

(7) That in the opinion of many agents the "Non-Medical" business thrusts undue responsibility on the agent;

(8) That there would be a tendency to dispute claims arising out of the misstatements of the applicants.

On the other hand it is pointed out that as a result of "Non-Medical" business there would be (1) a broadening and popularizing of the business, (2) an incentive to improve the standard of agents, (3) a diminution in the initial cost, (4) a greater inclination on the part of Courts to entertain a claim on the grounds of fraud or misstatement,—at the present time the Courts attach importance to the protection afforded by the medical examiner and are inclined to give the assured the benefit of the doubt where a dispute on the grounds of misstatement arises, (5) independence of medical examiners.

Application Form of a Certain British Company.

..... ASSURANCE COMPANY.

Proposal for Assurance—Without Medical Examination.

If a married woman state also maiden name.

Name (in full) of the Life to be Assured:
Residence:
Profession or Occupation:

Sum Assured £.... Table .... Term .... With..... Profits
Premium payable ....yearly

Date of Birth: Age next Birthday:

Note: In Proof of Age a certificate of Birth should be produced.

What is your Height? and Weight? Are you Married or Single?

To Whom the Society may refer

Names and addresses of two Friends or acquaintances of your own sex, who best know the state of your health and habits.

Name and address of the Medical Man who attends you or knows you through attendance on your family.
Have you any bodily Deformity? Inflammation or other Disease of the Disease of the Heart? lungs?
Spitting of Blood?
Have you had Rheumatic Fever? Pleurisy? Paralysis? or any fit?
State what other illnesses or diseases you have suffered from and when.
On what occasions during the last few years has illness caused you to be absent from, or incapacitated you for, your occupation for more than a week at a time?
Give the name and address of the Medical Man who attended you for the above.

If your Father, Mother or any Brother or Sister has died state in each case age at time of death and cause of death. (If none, state "None.")

Has any proposal for assurance on your life been declined or deferred by, or withdrawn from, any Assurance Office? or have you ever been charged an increased premium? If so, state name of Office.

State any additional facts affecting the risk of assurance and of which the Society should be made aware. (If none, state "none.")

I do hereby declare that the whole of the foregoing statements are true and complete.

Dated the ..... day of 19

Witness ..... Signature .....
The assurance will not commence until the first premium has been paid. *No Receipt is valid unless issued on the Society's Printed Form.*

Form Used by a Certain Canadian Company

Declaration of Insurability

to

The Life Insurance Company

in Lieu of

Medical Examination

N.B.—Every question in this form must be fully answered.

1. (*a*) Name? ..... (*a*)
   (*b*) Nationality and Race or Color? (*b*)
   (*c*) Married or Single ..... (*c*)

(State how determined)

2. (*a*) What is your exact height?... (*a*) .... Ft. .... Inches .....
   (*b*) What is your exact weight in ordinary clothes? ..... (*b*) .... Lbs. .....
   (*c*) Have you gained or lost weight? If so, give full particulars ..... (*c*)

3. (*a*) How frequently, if at all, and in what quantity do you use beer, wine, spirits or other intoxicants? ..... (*a*)
   (*b*) How frequently, if at all, and in what quantity have you used them in the past? ..... (*b*)
   (*c*) Have you ever used them to excess? ..... (*c*)
   (*d*) If a total abstainer, how long have you been so? ..... (*d*)
   (*e*) Have you ever used opium, morphine, cocaine or other narcotics ..... (*e*)

4. Family History—Do not use the terms "Heart Failure," "General Debility," "Change of Life," "Fever," "Dropsy," "Exposure," "Accident," "Childbirth," "Puerperal Fever," or "Don't Know," without a complete explanation.

	Living	Dead			
	Age, Health, Good or Bad? Give details	Age	Date of Death	Specific Cause of Death	Duration and Character of Last Illness	Previous Health
Father						
Mother						
Wife or Husband						

Brothers No.
Number living .....
Number dead.....
Total.....

Sisters No.
Number living .....
Number dead.....
Total.....

DECLARATION OF INSURABILITY—(*Continued*).

5. (*a*) Is there any member of your family suffering from consumption or any lung trouble? (*a*)
   (*b*) Have you lived in the same house or been associated in any way with any person suffering from Tuberculosis... (*b*)
   (*c*) Have you ever changed your occupation or residence for your health? ..... (*c*)
6. (*a*) Have you ever had any illnesses, diseases, operations or accidents? ..... (*a*)
   (*b*) Have you ever consulted a doctor? ..... (*b*)

(If so give full particulars in table below)

Illness, Disease, Operation or Accident	Date Month and Year	Duration	Name and Address of Doctors whom you consulted or who attended you

   (*c*) May the Company refer to the above mentioned doctors?.. (*c*)
   (*d*) Has any unfavourable medical opinion ever been given regarding your physical condition? ..... (*d*)
   (*e*) Have you any deformity or disability, such as spinal curvature, deformity, rupture, lameness, loss of limb, impairment of speech, sight or hearing, etc.? ..... (*e*)
   (*f*) Are you in receipt of any pension from the Government on account of military or naval service? ..... (*f*)
   (*g*) Are you now free from disease or symptoms of disease and in perfect health?..... (*g*)
7. (*a*) If from the information given herein the Company desire to have you examined by their medical examiner, do you agree to submit yourself to such examination? ..... (*a*)
   (*b*) Are there any special circumstances known to you which might affect the risk on your life?

8. Any additional information or remarks:

I certify that my answers to the foregoing questions and statements are correct and form part of my application for insurance to The Life Insurance Company. I expressly waive, in my name and that of any other person who shall have or claim an interest in any policy issued as result of these answers, all provisions of law forbidding any physician or other person who has attended or examined me or who may hereafter attend or examine me, from revealing any detail or knowledge which was acquired thereby.

Dated at ..... this .....day of ..... 19.....

....

Witness. Applicant.

Actuarial Note.

Insurance Without Medical Examination.

Savings in Expense Compared with Expected Extra Mortality.

BY

ARTHUR HUNTER.

The result of the announcement that several Canadian companies are prepared to issue policies for $1,000 without medical examination has naturally caused actuaries in the United States to consider the matter carefully. The only subject in connection with insurance without medical examination to which I shall refer at this time is the relationship of the saving in expense to the probable higher mortality under such policies. According to insurance periodicals, the principal reason advanced for issuing such policies is to save the cost of the medical examination, although it is also expected as a result that business will be easier to obtain, especially in outlying country districts.

While the British companies have for a number of years issued policies to adults without medical examination, there has been a lien against the face of the policy, such lien extending at one time to three years but now substantially shortened—in one company to six months. The majority of the Canadian companies intend, however, to issue policies without lien.

Another difference between the British and the Canadian policies may affect the question of issuing policies without medical examination,—namely, the apportionment of surplus. The British companies generally distribute their surplus triennially or quinquennially under the reversionary bonus system. Some of the companies allow no dividend in event of death before the end of the first three or five policy years, while others allow it at a lower rate than if the insured survives until the end of the bonus period. In Canada, on the other hand, most of the companies issue policies with annual dividends. If the Canadian companies limit the insurance without examination to the Five-Year Dividend Plan, they

would have a margin from the unpaid dividends in event of early death; this protection could not be obtained by American companies which operate in New York State, as all policies must provide for the distribution of surplus annually.

It may be well to point out that the original idea of the British companies in granting policies without medical examination was not to save expenses. In fact, in many cases a fee was paid to the medical attendant. There is no intention under the Canadian plan of referring to the family physician, but the practice would be either to accept the risk without medical examination, or to require an examination by the company's regular physician before considering the application.

Mr. Reid, in a paper recently read before the Insurance Institute of Toronto, states that "in all probability the extra mortality experienced will be offset by the saving in initial expenses."

The extra mortality under the policies without medical examination would arise *principally* from two sources: (1) applicants who conceal important information regarding their personal history or personal condition, *i.e.,* cases of misrepresentation or fraud; (2) applicants who have no knowledge of a more or less serious physical condition. With regard to (1), there would be a variety of impairments coming under this category, and these would probably increase the relative mortality in the early policy years. With regard to (2), it is probable that the main impairments would be heart disease, albuminuria, glycosuria, and tuberculosis,—any one of which disorders might exist without knowledge on the part of the applicant for insurance. As groups of such risks, accepted on underaverage plans, show a decreasing percentage of mortality to a standard "select" table with increasing duration of insurance, it is reasonable to expect the same condition in the case of groups of men who were unaware of their impairment. While, therefore, there may be reasons for expecting an increasing relative mortality for several years after the issue of the policy in certain types, it appears logical to expect that, on the whole, the principal causes would result in a decreasing percentage of extra mortality with respect to the Medico-Actuarial (Select), the American-Men (Select), or the Canadian-Men (Select) Table.

Let us consider the case of a company which is making a very careful selection in issuing policies without medical examination for $1,000 without lien. There will naturally be a great deal of

difference of opinion as to the probable incidence of the extra mortality, but it will generally be agreed that after a few policy years the group will be approximately as good as those who have been accepted in the usual way. The easiest way to consider this problem seems to be to determine the extra mortality which could be borne by an assumed saving in expense. Let us assume that such saving will be $5.00 per $1,000, the equivalent of which must be a decreasing extra mortality with increasing age at issue. Thus, in the first policy year the equivalent of an extra mortality of 50 per cent. of the American Men "Select" Table would be $1.33 at age 20, and $3.29 at age 50. It will be interesting to make an exhibit of examples of the extra mortality covered by $5.00 per

EXTRA MORTALITY ON AM (SELECT), 3%.

Equivalent to $5 per $1000 Expense in 1st Year.

Insurance Years.	Extra Mortality. Ages at Entry.		
	20.	30.	40.
	I.		
1.....	115%	105%	90%
2.....	42½	37½	27½
3.....	15	13½	10
	II.		
1.....	95%	87½%	72½%
2.....	35	32½	25
3.....	22½	20	15
4.....	12½	12½	8
5.....	5	2½	1½
	III.		
1.....	85%	80%	62½%
2.....	33½	30	20
3.....	22½	20	15
4.....	15	13	10
5.....	8	7	6
6.....	3	3	3
	IV.		
1.....	75%	70%	55%
2.....	28½	27½	15
3.....	20½	20	12½
4.....	15	14	10
5.....	10	9	7½
6.....	7	5	4
7.....	5	3	3½
8.....	3	2	2½
9.....	2	1½	1½

$1,000. As policies without medical examination will not be issued above age 40 or 45, and probably not at very young ages at entry, three ages have been selected for the exhibit, 20, 30 and 40. Six variations of mortality rates have been selected, covering the extra mortality rates most likely to be expected.

EXTRA MORTALITY ON AM (SELECT), 3%.

Equivalent to $5 per $1000 Expense in 1st Year.

Insurance Years.	Extra Mortality. Ages at Entry.		
	20.	30.	40.
	V.		
1.....	27½%	25%	20%
2.....	27½	25	20
3.....	27½	25	20
4.....	27½	25	20
5.....	22½	21	14
6.....	14	14	6½
7.....	5½	5½	1½
	VI.		
1.....	25%	23%	17½%
2.....	25	23	17½
3.....	25	23	17½
4.....	25	23	17½
5.....	20	18	12½
6.....	15	12	8
7.....	10½	9	5
8.....	6	6	2½
9.....	3	3	1½

A suggestion has been made that a rate of mortality equal to the ultimate rate of mortality might be expected from the date of issue. If so, the present value of the difference between the select and the ultimate mortality would not average $3 per thousand in a company limiting cases without examination to persons under 40 years of age. At age 20 the present value of the difference between the select and ultimate mortality is $2.13; at age 30, $2.79; and at age 40, $4.78.

From the first four tables it may be seen that at age 20 an extra mortality of about 170 per cent. can be borne, spread over a series of years, and that at age 40 the corresponding extra mortality would be about 120 per cent. This of course states the extra mortality in terms of one year's expected mortality. Whether this extra mor-

tality will be exceeded or not is a matter on which one actuary's judgment is as good as another's.

It is interesting to note that the trend towards eliminating the medical examination in Canada is opposite to the strong trend in the United States towards offering re-examination at stated intervals without expense to the policyholder. The former makes it easier to avoid a knowledge of one's physical condition, while the latter helps one to obtain a better knowledge, thereby conserving health. From the standpoint of the State, the more effective the measures to combat ignorance regarding health the better; hence, while the omission of the medical examination may be an advantage from a business standpoint, it may be a disadvantage from the community standpoint.

Whatever advice we may be disposed to give our own companies with regard to issuing policies without medical examination, we must admire the courage of the Canadian actuaries in trying a new experiment of this nature, and their ability in throwing around it reasonable safeguards.

Life Insurance Without Medical Examination.

ABSTRACT OF DISCUSSION OF FOREGOING PAPERS.

(WRITTEN DISCUSSION.)

MR. E. E. REID:

The subject of Non-Medical insurance is one that will doubtless prove of less interest to the actuaries of companies operating in the United States than to those of companies operating in Canada, not only on account of the special conditions which were responsible for the promotion of the idea in Canada, but also because of the greater possibility of such business proving satisfactory in the less congested population of that country. This observation is made because Mr. Kilgour's paper does not make any distinction between the two countries, and it leaves the impression that the action taken by some of the Canadian companies might be considered quite as applicable in any part of the United States as in Canada. I doubt if any of the companies would take that view, even if such considerable safeguards were adopted as those now in use by the five Canadian companies actually engaged in the business.

The whole tenor of the paper seems to show a somewhat unsympathetic attitude, and this impression is emphasized by the very scant references made to the restrictions and safeguards adopted and the advantages to be gained. Mr. Kilgour quotes at very considerable length an opinion offered by Dr. Bramwell in discussing Mr. Nicoll's paper, but this opinion is so evidently dictated by prejudice that little weight can be attached to it, and, as a matter of fact, subsequent experience has pretty completely answered the arguments advanced. Sufficient indication is given by Mr. Kilgour of the history of the Non-Medical system in Great Britain to show that actual experience has led many of the actuaries in that country to view with great satisfaction the result of the experiment made there. Now, notwithstanding the amount of Irish blood that the average Canadian may have in his veins, we in Canada, on the whole, have wonderful admiration for the people of Great Britain, not excepting the actuaries and other officers of the life insurance companies there. We can not believe, therefore, that if any considerable proportion of the disasters prophesied twenty or more years ago had proven correct, any British company of established reputation would now have released Non-Medical policies of all restrictions from the commencement of the insurance.

The conditions which induced a demand in Canada for Non-Medical insurance were, briefly, these: The war had created a great

dearth of medical examiners, particularly in the Western provinces, and great quantities of business were held up, and much of it never finally passed because of the impossibility of getting it examined; the tremendous pressure of business in 1919 and 1920 made the strain upon many of the companies decidedly inconvenient, to say the least, and methods of relieving that strain for the initial year of the business, at any rate, were eagerly sought; the general increase in professional fees naturally induced medical practitioners to look for increased fees, and action by certain of the Medical Associations doubtless added its quota to the agitation for Non-Medical business, at least for the smaller amounts of insurance which could not stand any increase in initial cost.

Another field of usefulness for the system and a strong reason for its introduction is its applicability to female risks—a feature to which little reference is made by Mr. Kilgour. Consideration of the freedom of women from war service, the constantly low rate of mortality shown to exist amongst females in all investigations and this favorable result being obtained in spite of acknowledged inferior medical report, makes it appear reasonable to expect very favorable results in the case of female risks if, of course, proper care is exercised in the selection. It would not be surprising to find that the experience on this business would justify the introduction of Non-Medical applications if used only for female risks.

The results of introducing a system of Non-Medical applications are undoubtedly of such a nature as can be determined satisfactorily only by actual experiment, and in making such an experiment the restrictions imposed in the selection of risks are likely to err on the safe side. The Canadian companies adopting this system for policies, other than for small Weekly Premium insurances, have placed such safeguards as the following:

1. Amount of insurance limited for the present by all companies to $1,000.

2. Minimum and maximum age limitations 21 and 45 respectively, although there are variations within these extremes.

3. No option is allowed as between Medical and Non-Medical applications, except on the part of the company.

4. A difference in the practice exists as to urinalysis, at least one company requiring it in the case of all male applicants.

5. A clause which has been found exceedingly satisfactory in connection with the conduct of "Weekly Premium" business is specially applicable to Non-Medical Ordinary business, and experience indicates that while it is a decided protection to the company, it is quite acceptable to the insured and to beneficiaries under life insurance contracts. The clause reads as follows and is included in the application and policy of at least one of the Canadian companies writing this business:

"If the Insured has had, previous to the date of application,

consumption or any form of tuberculosis, cancer or any form of malignant disease, any chronic disease of the heart or kidneys, or any chronic or incurable ailment, whether the Insured has or has not answered the question relating thereto in the application, or if any material representations in the application are untrue, then this Policy shall be void and all premiums paid forfeited."

6. Careful investigation as to continuous employment a condition of acceptance.

7. Lien of varying amount, according to plan, and running for a period of five years, is imposed in the case of married women under 40.

8. An independent report from an Inspector not in the company's employ is required in every case.

9. A Central Bureau has been created to which the name of applicant is immediately transmitted and which reports immediately by wire if any similar application has been made to any other Company.

The experience so far shows that some of the fears expressed by Mr. Kilgour are not justified. The agents are certainly not clamoring for the business, and instead of the amount applied for being reduced, a very noticeable increase in the amounts has taken place in all districts where the system has been introduced, thus showing a decided disposition to throw the responsibility on the Medical Examiners. The desire of the agents to be relieved of responsibility is further indicated by the fact that in one of the largest agencies operating this business the practice was started immediately of writing applications for $1,100 on which examinations were made. Definite prohibition of this practice had to be made and the agency required to write the Non-Medical unless the amount was for $1,250 or $1,500 at least.

I should be inclined to say, from personal experience, that the independent inspection being obtained is more valuable than the inspection by the company's officials, to which such importance is attached by the officer of one of the large American companies. We have, indeed, had instances where the outside inspection made clear the desirability of postponing or declining the risk, but subsequent medical examination found no impairment—the ultimate result proving the Examiner to be either careless or indifferent to other than purely physical conditions.

Having been associated with a company that has taken Non-Medical applications for smaller amounts for a period of more than a third of a century, I have every confidence that the extension to larger amounts will prove satisfactory, to the extent at least of justifying the experiment; and it may even be found possible, ultimately, to increase the limit. The system will almost certainly eliminate from the company's staff, in time, the agent who is indif-

ferent to the company's best interests, so that while at first good men inexperienced in the business may have some fear that it is inadvisable to join forces with a company issuing this class of business, such objection is not, I think, likely to be of long life.

Altogether, it seems reasonable to assume that the precautions taken by the Canadian companies are more than ample to insure a reasonable experience. The saving in expense and the resulting widening of the scope of the business and the reaching out into the more sparsely populated sections of the country should make the experiment worth while; and, indeed, even the extension of the protection to certain classes of lives that might not, on close medical examination, be accepted is by no means altogether an undesirable outcome. It is hoped that more of the Canadian companies will join with those already engaged in the business, and that the ultimate experience will be of benefit to life insurance throughout the continent.

Mr. Rose: There has been some discussion as to whether or not there is any real demand for this kind of insurance on the part of the public. I would like to know whether the Canadian companies doing it have found that there is a real demand for it and that consequently their business has been considerably increased.

Mr. Reid: I don't see that there is any particular demand for it; the conditions are about as outlined in the criticism just read. The public are not demanding it.

MR. R. D. MURPHY:

Mr. Kilgour has given us an interesting historical review of the instances in which life insurance has been issued without medical examination. The early history of this subject reflects the conditions surrounding the insurance business in its infancy, before life insurance became such a familiar subject with the public, and also before any extensive development of the science of selection had taken place. The lack of a medical examination at that time was, therefore, not of the same importance as it would be today.

When some of the British companies returned to this practice about 1890 it was apparently an attempt to increase the popularity of life insurance. I am not deeply impressed with the argument that popularity will be brought about in that manner. In my judgment, there is not any noticeable popular feeling that the medical examination is an unreasonable requirement for the issuance of a policy; nor do I believe that any appreciable number of people are deterred from applying for life insurance because of the examination, if they believe themselves to be in good health. Plans which include a restriction in benefits could hardly be expected to gain great favor in this way. I fear that the popularity which life insurance, even without restrictions, would attain by the omission of this requirement would be largely confined to those who have a doubt regarding their insurability.

Mr. Kilgour has not mentioned the issuance of group insurance, within recent years, without examination. This class of insurance is peculiar in that the inclusion of any individual does not generally depend upon his voluntary application. In such a case medical examination might well be both unpopular and unnecessary. Attempts, however, to extend such a practice to ordinary voluntary insurance is a step away from the scientific development of underwriting and from the soundness of our present life insurance institutions.

The *Transactions* of this Society bear some testimony to the modern development of selection based upon statistical analyses. These statistics are based in quite large measure on the findings of the medical examiner. A proposal to omit such findings is necessarily a suggestion to stop classifying risks in some of their most important aspects. Is this not an attempt to run counter to the competitive system under which we live? There may be those who feel that a refined classification of risks is fundamentally undesirable, and that, so far as practicable, it is better for all to share the insurance burden alike whether they be somewhat impaired or in first-class condition, but I believe that such doctrine is inconsistent with our present social organization. Competition forces us more and more to make each person pay the proper premium for the type of risk which he represents as nearly as we can determine it.

Several States have statutes on their books requiring examination before a policy may be issued. Are not these statutes specifically intended to prevent the hidden discrimination that would occur in favor of impaired lives and the possible weakening of the companies, if the material for medical classification is not presented?

Mr. Hunter, in his note on this same subject, has mentioned that the modern tendency is to re-examine policyholders rather than to omit examinations. In other words, the modern life insurance company's function may well be considered to include conservation of life as well as indemnification for death. The facts revealed by examinations are undoubtedly of some influence in inducing policyholders to remedy impairments which are disclosed. Self-interest urges them to attain satisfactory insurability, either in order to obtain insurance which has previously been refused them or to secure a lower rate if they have been accepted on a sub-standard basis. Even though such an effect be slight, it is in the right direction.

On the other hand, the acceptance of applicants without examination offers an unwholesome inducement to those who suspect some hidden ailment. Not only may gross frauds be made easier, but also many persons with somewhat easy consciences will be encouraged to take what sophistry makes appear to them a reasonable advantage. This is an unfortunate influence for our business to

exert. The practical result of such temptations could be expected to lead to a high mortality in the early policy years.

Mr. Kilgour has well pointed out that, in addition to such sources of extra mortality, there are many important impairments which are commonly unknown to applicants. The admission of such a class would tend to produce a more persistent extra mortality in addition to the high mortality in the first few years. Mr. Hunter says: "It will generally be agreed that after a few policy years the group will be approximately as good as those who have been accepted in the usual way." This is a matter in which we can not speak with any assurance, but I have the feeling that we may reasonably expect a greater extra mortality in the later durations than is shown by Mr. Hunter's tables, in which he exhibits types of extra mortality equivalent to $5 initial expense per $1,000 of insurance. In any event, it would seem to me that unless the expense of medical examination is considerably in excess of $5 per $1,000 on business to be accepted in this manner, provision should be made for a special dividend classification or a moderate extra premium until a sufficient experience has been gathered to determine the nature of the mortality.

In spite of the objections which I have to insurance without medical examination, I appreciate that the force of circumstances may require it, if the expense of the medical examination increases to an amount which is in excess of the value of any extra mortality that may be incurred. The probability that this is the case seems to me the only adequate justification for a company to issue ordinary individual life insurance in this manner.

MR. M. ALBERT LINTON:

Strange things have come to pass when a capital and labor issue furnishes a topic for discussion by the Actuarial Society. Yet such would now seem to be the case. On the one hand we learn that there has been agitation for increased pay by members of the Medical Association; and on the other that, as a result of such agitation, certain life insurance companies in Canada have been hastened in their determination to establish a kind of "lock-out" against the doctors as far as $1,000 applications are concerned. As usual the interests of the public are affected. Whether for better or for worse it is perhaps too soon to say. However, that question is fundamentally the one upon which the interesting papers of Messrs. Kilgour and Hunter attempt to throw some light.

For the purpose of obtaining light upon some of the details connected with the conduct of the non-medical business, the following five questions are presented, together with tentative answers, with the hope that those who may be connected with companies operating under the plan will correct me if the answers given are not supported by experience. What I shall have to say will relate only to

ordinary business, and not to weekly premium or intermediate business:

1. When a company adopts the new plan, does it automatically do away with the medical examination for all applications of $1,000 or less, or does the applicant exercise a choice as to whether or not he shall be examined?

It would appear advisable to do away with a medical examination in connection with every application for $1,000 or less where the existence of insurance formerly issued on the same life did not prevent its consideration upon a non-medical basis. To allow a choice is to extend the opportunity for adverse selection, which in turn would tend to force a separation of the medical and non-medical groups for purposes of surplus distribution. This in turn would intensify the selection, as the medical plan under such conditions would probably exhibit the lower cost.

2. If a $1,000 policy without medical examination be issued, will the company at some subsequent date, say one, two or three years hence, consider that the policyholder is eligible for another policy without medical examination?

Within certain limits, why not? If a non-medical policyholder lives a few years and is able to answer satisfactorily a new set of questions, the added risk by reason of his existing policy is relatively small. I should think that in the case of a well-established company the amount might be increased at intervals of two or three years up to, say, $3,000.

3. If an applicant is already insured for at least $1,000 in the company under a policy formerly taken out with a medical examination, will consideration be given to his application for a new non-medical $1,000 policy?

The answer to this question would seem to follow the lines of the previous answer. If the amount already carried be less than, say, $3,000, why not allow it to be increased at appropriate intervals to the permitted maximum in units of not more than $1,000?

4. What age limits are imposed?

It would seem desirable to eliminate the risks above age 50, or perhaps age 45, and also those below 20.

5. If the companies that have adopted the new system establish an information bureau, what limitation will they impose if it be discovered that an applicant is favoring all or some of them simultaneously?

This is undoubtedly a difficult question. Until a volume of experience has been obtained it would probably be advisable to limit such cases quite rigidly, and to require a medical examination if more than $2,000 or $3,000 were involved. If application should be made to several companies at reasonable intervals, it would probably be safe to consider the case if in other respects it were first class.

After all is said and done, however, is the game worth the candle? Do we not have collateral effects arising out of the practice that from the larger point of view of general policy make it undesirable? For example, it is suggested that the courts would probably give the companies a more favorable hearing in non-medical cases contested because of misstatement on the part of the applicant. I question whether this is wise. It appeals to me as a better general principle to make the initial examination of the risk from all points of view as complete as possible, so that when the policy has been issued, the insured may enjoy the maximum feeling of certainty that his beneficiary will not be deprived of protection by litigation on the part of the company. The present practice of having a short contestable period, coupled with a careful selection, provides an element of certainty that should not be disturbed.

Again, the saving of the medical fee will be partially offset by the expenses attendant upon a more careful investigation of the risk through channels other than medical. There is the cost of the central information bureau, the possibly more than average correspondence cost, and finally the charge for the mercantile report which Mr. Kilgour says is required in each case. These reports cost at least $1 in the United States. In New York and a few other large cities they range up to $2. In some companies the mercantile report is required on all risks irrespective of amount. In many others, including our own, it is not required on $1,000 applications. For these latter companies, therefore, the saving in medical fees would be offset by the cost of the inspection report.

I find that during the first four months of this year 36 per cent. of the number of policies issued by our company were for $1,000. It is also interesting to note that among the applications rejected during the same period 35 per cent. were for $1,000. An estimate of the medical fees paid upon $1,000 applications submitted during the four months amounts to about 35 per cent. of the total medical fees paid during the period. For us, therefore, taking into account the mercantile report which would have been required if the medical examination had been omitted, the maximum net saving would have been less than 28 per cent. of the total medical fees. Now, this saving would not be of much consequence when spread over the entire body of policyholders, especially in view of the fact that it would still further be offset by the undoubtedly higher mortality of the non-medical policyholders.

Of course, if a special dividend class were established and the saving in acquisition costs were credited to that class and the actual mortality cost charged against it, a noticeable difference might show itself in the net cost; though whether or not it would be a decrease would be hazardous to predict. However, the difference, in whichever direction it might tend, would probably be small even when confined in its effect entirely to the group of non-medical

policyholders. Therefore, as far as saving in cost is concerned, I would feel that it is too small a matter to be worth all that it involves. The only exception would be the case of a company which did not have sufficient first-year margins and could therefore better afford to incur an increased future mortality than to pay the initial medical fee.

Another consideration that in time might have a bearing upon the matter of cost is the attitude of the examining physicians who would experience a considerable decrease in income from their life insurance work because of the non-examination of the smaller cases. The agitation for increased fees might be stimulated and pushed to a successful conclusion. A 50 per cent. increase in fees on the business upon which examination is necessary would play havoc with the saving on $1,000 cases.

From the point of view of public policy, I doubt if a move to abolish medical examinations, even upon a very restricted class of ordinary business, is a wise one. The facilities for having applicants examined are increasing continually, and even in the country districts of the United States it is reasonably easy for applicants to be examined. The man who refuses to be examined does so either because he is concealing something which he fears the examiner will discover, because he does not want to take the trouble to undergo the examination or shrinks from it. Those actuated by the first motive should obviously be required to be examined. For those actuated by the other motives we have more sympathy, and if the examination barrier were removed it is quite possible that they would furnish increased business of a desirable character. But is it not better policy to retain the examination and in time educate the community to the point of recognizing the value of the medical examination as an important social factor? Many an applicant has had remediable defects brought out by a life insurance examination that otherwise might have remained undiscovered until too late. Many another has learned the value of periodical examination and has voluntarily sought to be examined when no new insurance was involved. It may be interesting to know that medical examinations were not required in the pioneer days of life insurance history; but that fact, it seems to me, does not help in the solution of our present problem. Conditions in the insurance world are now totally different and our knowledge of what is good for the community at large has broadened tremendously. Practices should be tested by their suitability under modern conditions, not by their antiquity.

Another consideration is whether it would be possible to extend the non-medical feature to applications exceeding $1,000. If that were done and the maximum should extend, say, to $5,000, the influence of selection would become so great that the pressure for the establishment of medical and non-medical classifications, either

as to premium rates or dividends, would become too insistent to be denied. In fact, in our mutual companies it would be essential to the principle of mutuality that the classification be made. This principle of classification in itself would appear to render impracticable the establishment of the larger limit for non-medical cases. The sound risks would choose the examination in order to benefit by the lower net cost. The unsound risks would automatically tend to concentrate in the non-medical group, probably defeating the scheme. But granting that a raising of the non-medical maximum were possible from a practical point of view, I would not like to see it take place. The great desideratum in life insurance is the possession of an adequate and accurate standard of selection by which we can classify the risks presented for consideration. This standard depends upon scientific data. But the omission of the medical examination in connection with a large percentage of our business would deprive us of certain accurate statistics which we now obtain and would, I believe, be a retrograde step which later on we would regret.

Finally, the effect upon the agency force of this non-medical principle is an interesting consideration. As has been pointed out by Mr. Kilgour, the tendency seems to have been to limit the amount of the application to $1,000 in many cases where a larger amount would have been delivered if the risk had been medically examined. Will not the ultimate tendency of the non-medical practice be to educate many of our agents to a $1,000 standard and thereby tend to lessen the service we should be rendering to the community? Again, if it were possible to obtain several $1,000 non-medical policies by applying to several companies simultaneously, the agent who started the ball rolling by his original solicitation for a $1,000 non-medical policy might not feel so enthusiastic about the system. He might, indeed, receive commission from all of the companies; but if he had never had occasion to direct the applicant's attention to the non-medical method of obtaining insurance, he would probably have been able to submit the total amount in one application to his own company.

The thought that in non-medical cases the agent should be held to greater accountability in the selection of the risk does not appeal to me at all. We desire our agency forces to be kept to a high point of efficiency and integrity, and I doubt whether we would succeed as well as if we should set up a double standard, asking for greater care where the examination is waived. The probable result would be that with the larger applications less care would be exercised than is now the case.

It is evident from what has been said that I would be loath to recommend the non-medical principle for a company in the United States even if we could properly introduce it under the various laws to which we are subject. The saving, if any, would probably

be small, but apart from the cost, the collateral effect upon the insurance business and upon the community would, on the whole, not appear to be beneficial. There is no doubt that the non-medical method can be developed with sufficient safeguards to make it possible to write a large volume of business under it. However, I believe that the energy required to develop the new method could better be applied toward improving and developing the existing methods of medical selection. It is quite possible that we may have developed the medical blank to a point where it has become too formidable. If so, it should be revised and simplified; but that is another matter—quite different from adopting the policy of doing away with it altogether where certain amounts of ordinary insurance are involved.

MR. V. R. SMITH:

The thanks of the Society are due the author of this paper for the introduction for discussion of a subject new to this continent, although well known in England.

The author states that "the object of his inquiry is to direct attention to fundamental principles, and more particularly to examine, in the light of those principles, the wisdom or expedience of accepting risks without medical examination."

The broad general question of the advisability of doing a life insurance business without medical examinations, such as was the general practice in England prior to 1860, or by means of the various methods in operation in that country subsequently, whereby an extra premium was charged or a lien imposed, has no interest to the underwriter of today, except perhaps in an historical or academic way. However, the method by which some of the Canadian companies are selecting a portion of their risk is so fundamentally different to the schemes adopted in England more than twenty years ago, and in existence today in a modified form, that I ask the indulgence of the Society in departing from the limits of Mr. Kilgour's paper and dealing entirely with the Canadian system.

Life insurance without medical examination had been discussed in an academic way for some years by Canadian actuaries, who were endeavoring to avoid the difficulties arising out of the inability of the companies to obtain medical examinations promptly. Doctors, scarce at any time, were more so during the war, and especially was this the case in the more sparsely settled parts of Canada. About 50 per cent. of the examinations made are for $1,000 policies, and since about 75 per cent. of these risks are unblemished, it was believed that a method could be devised of selecting these risks profitably without the trouble of a medical examination. A study of the English schemes gave weight to this opinion, since the companies doing this class of business might be numbered among the strongest and best known anywhere. This opinion was the more strongly held when it was noted that these same life companies,

known the world over for their soundness and conservatism, had steadily removed the original restrictions and had made their schemes more attractive and liberal, so that today it is possible to obtain a £1,000 policy without medical examination, on the same terms as if medically examined.

Consideration of the factors entering into the selection of risks for life insurance showed that the medical examination affected one of these factors almost entirely and two others to a smaller degree, viz., the physical condition and the personal and family history, the latter two factors by reason of the greater accuracy with which replies would be elicited to the questions of a skilled physician. The other factors could be determined as accurately by the agent as by the doctor. From our limited experience, we believe that we are obtaining a fuller and more accurate family and personal history than ever before, by reason of the care the applicant gives to his answers, knowing that the contract is based upon the truth of his answers rather than on the skill of the examiner to detect any impairment. Accordingly it is believed that practically the only danger companies run in accepting impaired risks at standard rates is limited to the following classes among those who are not aware of any impairment:

1. Those suffering from latent tuberculosis.
2. Those with impaired hearts.
3. Those suffering from some impairment which would be disclosed by a urinalysis.

So far as latent tuberculosis is concerned, how often is it discovered by the doctor, who himself is usually one of the first to claim that it is practically impossible to detect a latent case in the time given to the usual insurance examination?

It is altogether likely that companies will accept a number of heart cases which they would not have taken at standard rates if the risk had been medically examined, but the limitation of age and the readiness to demand a medical examination, if the other points in the risk are not up to a high standard, will likely compensate for these few cases. In addition, I believe I have heard the statement go unchallenged at a Medical Directors' meeting that in only 50 per cent. of the cases is the doctor's diagnosis of the heart impairment correct. If this statement is true, the average mortality in this case is likely to be affected less than we estimate.

In the company with which I am connected no urinalysis was required, for amounts of $2,000 and under, for a period of thirty years, and so far as I am aware no harm resulted from the omission of this report.

You will note that cases endeavoring to defraud were not mentioned, and deliberately so, because it is believed that a man will not endeavor to defraud for the sake of $1,000 insurance. It is likely that he will try to pass a doctor, both with a view to a larger

amount and also having regard to greater security in possession of the insurance, should the policy be issued.

A study of these features convinced some of the Canadian actuaries that by obtaining the completion of a questionnaire by the applicant, making definite and exact statements as to his past and present state of health, his family history, his habits, his height and weight, insurance without medical examination, within certain limitations as to age and amount, might be done with profit on the same basis as if the risk had been examined. These limits were fixed at a minimum of 20 and a maximum of 45 for age, and a maximum of $1,000 for amount. Further protection is given by obtaining an independent inspection report from one of the commercial companies, such as Bradstreet's or the Retail Credit Company; also by setting up a central bureau, to which all applications without medical examination are reported, in order that those applying to several companies within a short limited time might be carefully investigated. Up to date we have had only seven instances of applicants applying to two companies and none applying to more than two out of a total of 3,500 applications to all companies.

The Canadian system differs in one important particular from its English predecessors, viz., in the requirement that no applicant for $1,000 or less shall be examined, if he falls within the age limit, unless at the option of the company. By this means it is expected that an adverse selection will be avoided and a broad average given to the scheme.

The English schemes are more liberal in several particulars, since some of the English offices have no limit as to age, and accept £1,000 or less without extra premium or lien. We confidently expect, however, that our experience will be so favorable that we shall be able to extend our present limits.

I might answer some of Mr. Kilgour's conclusions by quoting extracts from Mr. Nicoll's paper, or from the discussion that followed, but perhaps you would prefer that I give you some of the results of our actual experience, which, however, is too short as yet to do more than indicate the trend the scheme is likely to take.

1. We have no reason as yet to suspect any fraudulent selection, but, on the contrary, believe that, on the whole, we have more accurate information regarding the general health, habits and history of the applicant than ever before.

2. In view of the increased liberality of the English schemes, the estimate of 20 per cent. for the increased mortality is too high, if it is considered to run throughout the lifetime of the business. Mr. Hunter's opinion is, I believe, the correct one—"that after a few policy years the group will be approximately as good as those who have been accepted in the usual way." It is to be remembered in this connection that $5 was not the limit of the medical fee, but

that members of certain medical associations circulated pledge cards, pledging themselves to charge a minimum fee of $10. The lessened initial expense, together with the stricter selection, will likely balance the increased mortality cost.

3. Mr. Kilgour's third conclusion is open to question when consideration is given to the carelessness of some medical men in dealing with small applications, as compared with the care our agents advise us the applicants display in completing the questionnaire.

4. The company can certainly do a sub-standard business safely, even though it may be selecting some of its risks without the aid of a medical examination. Where the original application has been made under the non-medical system, my company has issued sub-standard policies both with and without the medical examination, the latter being required when there is reason to believe the applicant's physical condition may not be first class.

5. Perhaps it is yet too soon to give a definite answer to the proposition—"whether or not the 'non-medical' company would be able to attract the best agents is open to doubt"—but we are advised by our provincial managers and inspectors that they have found it a very valuable aid in attracting men of standing and integrity, since the company, by placing increased responsibility upon the agent and having confidence in him, enables him to write his business with less trouble than heretofore.

6. Our statistics regarding the amount of the individual policy do not supply the answer to the fear frequently expressed that policies for smaller amounts will ensue. Perhaps smaller policies will be the result of the experiment, though I doubt it, since the agent does not talk $1,000 till the last resort, but, even so, if it were the case, the agent is likely to write the same volume of business on a greater number of lives. However, so far we notice no difference, except that where an agent is timid and does not like the added responsibility he writes his prospect for at least $1,500.

7. I can not say that we have had any complaint from any number of our agents about undue responsibility. The opinion we formed of the reception given the scheme by our agents was that they welcomed it as an evidence of the company's confidence in them, and as an opportunity to close business readily and quickly—a thing which before had been impossible, resulting in many cases in the ultimate loss of a considerable amount of business.

8. I do not believe the companies will be any readier to resist claims than they are today, but I do think that the companies will be able to settle fraudulent claims without the recourse to the courts, in a way they have not been able to do in the past.

One of the advantages claimed for the "non-medical" system is a "diminution of the initial cost," but I am somewhat skeptical on this point, because I do not think there will be any perceptible profit made by eliminating the medical fee. The extra loss from

mortality will likely account for a large proportion of the fee saved.

"Independence of Medical Examiners"—another advantage claimed—might be construed as if the companies had acted in a way that was antagonistic to the medical examiner, but, needless to say, this was not the case, since the companies value highly the good will and coöperation of the medical examiner. Instances are on record where the doctor, the only one in the community, has expressed the wish that he might be relieved of life insurance work, on the ground that he was too busy and, accordingly, did not receive a sufficient remuneration.

The crux of the situation is that the companies inaugurated the "non-medical" procedure of selecting their risks as a means of avoiding the delay in obtaining the medical examination with consequent loss of business. "Independence of Medical Examiners" and "diminution of initial expenses" were not taken seriously when making the decision.

I believe that the future will prove the experiment to be sound and as profitable as the business medically examined, and that in a few years applications for at least $2,500, and perhaps $5,000, will be as readily accepted without medical examination as the $1,000 is today.

MR. WILLIAM A. HUTCHESON:

The idea of providing life insurance without medical examination and thus reverting, in some measure at least, to the simplicity of the early days in that respect is by no means novel, as it is now over thirty years ago since one of the British life insurance companies first put forward a scheme for such insurance. Notwithstanding the success which that company has had and the progressively increasing liberality with which it has been able to handle that class of business, other companies have been slow to follow and, where they have done so at all, it has usually been on some very conservative plan surrounded by many restrictions and safeguards. It is, perhaps, rather surprising that this has been so, and that after thirty years of trial the system in its more liberal forms has been, by nearly all the companies, left severely alone.

The development and history of the so-called "non-medical" plans in Great Britain has been dealt with at some length in the papers which have been referred to and it is not necessary for me to go over that ground. It is interesting, however, to remark in passing that the reasons which have led to an active interest in the subject at this time on this side of the Atlantic have had little or nothing to do with the action of those British companies which have displayed any interest in the subject. Here the question of the amount of the medical fee, forming as it does an appreciable part of the initial expense in small cases, and thus aggravating the artificial position created by existing valuation laws, has had a

good deal to do with the question, and the idea that a little extra mortality spread over a few years (a tacit admission of the value of medical examination) is better in the circumstances than a lump sum added to the already high first year's expenses has been in the minds of some.

In Britain, on the other hand, the expressed intention has been benevolence (in a sense) to the insuring public. Thus the company above referred to says in one of its publications: "The system of life assurance without medical examination was devised with the object of encouraging thrift." With this in view it at first prohibited assignments of such policies and excluded financial policies from the benefits of the system. No doubt, however, the obvious advantages to be gained, such as the extension of and facility in handling business and the reduction of expenses, were not altogether lost sight of.

With the object of ascertaining the present point of view and practice of the British companies on this subject, I have recently been in correspondence with the actuaries of some of these companies and have obtained from them not only information as to what is actually being done at the present time, but also expressions of opinion regarding the whole question, which are certainly of considerable interest, and for quoting which I therefore need offer no apology.

Before doing so I shall briefly refer to the present state of development of "non-medical" business in Great Britain.

Excluding industrial and government policies and certain other special classes, there remain three types of non-medical insurance, viz.:

(*i*) Double Endowment Insurance;
(*ii*) Insurance on regular plans without medical examination, but subject either to extra premium or to important restrictions;
(*iii*) Insurance on regular plans without medical examination and without restrictions except as to amount and age.

Double endowments scarcely deserve mention in this connection, since the nature of the benefit is such that there could be very little need of a medical examination in most cases. In fact, in the later years, a heavy mortality is favorable rather than otherwise. All the companies write such policies and usually premiums are based on the length of the endowment period alone, being the same for all ages unless where the period is prolonged.

The second class, namely, insurance on regular plans subject to extra premium or restriction, has been adopted, so far as I am aware, by not more than a few companies, and in some cases the scheme is adopted to some extent as a means of attracting applicants who are subsequently induced to take regular policies by ex-

amination in the usual way. The amount of the extra premium is apparently arbitrary or practically so. Thus one company offers the alternative of an extra premium of one per cent. for the first year and half of one per cent. for the second and third years, or a temporary "lien" on the policy amounting to two thirds of its amount in the first year and one third in the second year, the full amount being payable thereafter. I do not know whether or not much business is transacted under these restricted schemes, but the presumption would be that there is not, since the tendency of those seeking non-medical policies would, of course, be to select the companies offering unrestricted insurance. This tendency is indicated in Mr. E. E. Reid's paper to the Toronto Insurance Institute, where he refers to the possibility of a number of companies taking similar action as to the establishing of these schemes and thus avoiding a concentration of the business. It is, however, doubtful whether such a concentration would or would not be a bad thing for the company concerned.

As regards plans of non-medical insurance restricted only by age and amount, only two companies, so far as my information goes, have schemes in operation, and one of these confines the benefits of its plan to existing policyholders who have been medically examined within five years, and also limits the amount to an amount equal to the existing insurance effected by medical examination within five years and the plan to a plan not cheaper than such previous insurance. The amount of insurance effected subject to these limitations is, however, free of any such restrictions as are referred to above.

The second company, already referred to as the pioneer of non-medical insurance, has within the past few months removed the last remaining restriction (apart from age and amount) and now transacts such insurance, except at ages over 50, on the broadest and most liberal scale possible up to a large limit. The final restrictions to be removed were those limiting the amount payable in event of death within the first six months and the limitation on assignments. The fact that these policies are now absolutely without conditions of any sort is a most significant and striking commentary on the possibilities of successful operation of life insurance without medical examination.

Reliance is placed in all normal cases entirely on the statements in the application and declaration (which are of a remarkably simple character) and on information obtainable from the friends and medical man referred to by the applicant.

In spite of all that is to be said in favor of dispensing with medical examination, it would appear, however, that the bulk of actuarial opinion in Britain is against such a move; this is largely a purely conservative standpoint, but the numerous and apparently valid disadvantages no doubt also carry weight as well as the possi-

bility of alternatives. The most important of the disadvantages are perhaps the increased chance of fraud, the overlooking of medical impairments unknown to the applicant (such as glycosuria or albuminuria and certain heart conditions), the failure to detect bad habits, and the possibility of attracting a larger volume of doubtful cases, but there is a good answer to all objections, namely, that the scheme is in successful operation.

MR. A. D. WATSON:

Insurance without medical examination is not new, but it has recently assumed new importance in Canada at least. As is made clear in Mr. Kilgour's paper, there is so little experience available that conclusions in respect of any feature of the business are as yet unwarranted. As in other phases of the development of life insurance, the practical value of this innovation can only be finally determined by trial. In general, restrictive enactments, or control by authority, in respect of the details by which business is to be carried on, must, in the long run, have a pernicious effect. It is satisfactory that companies in Canada are free to give non-medical insurance a fair trial, and, if possible, unrestrained, develop suitable business methods in its practice. We may rest assured they will, for their own safety, proceed with such caution as will prove a far better safeguard than any preconceived restrictions. It is a bit anomalous to have arbitrary laws, rules and regulations in respect of some details while much more important matters of business are left, and properly so, to the judgment of those responsible for the safe conduct of the business as a whole. Good business methods are not perfected in vacuo. But before attempting to move forward it is usual to project as accurately as possible the results of each step. It is the intention to call attention here to some possibilities of non-medical business.

Where a medical examination is required, may it not be that the applicant in many cases feels that responsibility is in large measure shifted to the examiner; that he is justified in remaining silent about personal defects which the examiner fails to discover, thinking, perhaps, if undetected, that these defects must necessarily be unimportant? Likewise, when there is a medical examination, does not the agent feel that practically all responsibility is shifted from himself to the examiner? He would seem to be to a material extent induced to work, if not against the company, at least not directly in the company's best interests. In non-medical cases both the applicant and the agent, it would seem, would usually feel more imperatively the duties resting upon them, as they would more actively participate in preparing the application. The agent would know that his right to do non-medical business and possibly his reputation as an agent and his position with the company were at stake. He might well be required, in each case, to exercise his dis-

cretion as to whether he is prepared to have the application entertained without medical examination, even when the amount, occupation, etc., comes within the company's rules. This should conduce to great care in general, and so it would seem not unreasonable to hope that in special occupations with tried agents, and after due experience, non-medical policies for substantial amounts may be written. Of course, if some agents are permitted to write non-medical business, while others are not, it may well be a source of disaffection in the agency ranks.

Mr. Hunter's paper deals wholly with the extra mortality which may be covered in the early insurance years by an assumed saving in initial expenses of $5 per $1,000. This assumed saving was doubtless fixed upon, as $5 is usually the amount of the medical fee. It was, however, the prospect of higher medical fees which turned the attention of companies to non-medical insurance, and, so far as these companies are concerned, it is, perhaps, in terms of a rather higher initial saving that the figures should be interpreted. On the other hand, however, if policies of larger amounts come to be written without medical examination, the extra mortality covered by the assumed expense saving would be much reduced; while if the amount is limited to $1,000, the extra expense of handling small policies will cut considerably any possible saving.

While taking note of the saving in certain items of expense the less obvious increase in other items should not be forgotten. Non-medical business for many purposes will be regarded as a new class with all the incidental trouble and expense, mainly at the Head Office; and from this point of view the business, especially at its inception, may be expected to conform somewhat closely to "border-line" cases, or some substandard classes. These classes of business are a by-product of business as ordinarily done, and it becomes a question merely of using the by-product in the most economical manner. The same amount of Head Office expense per $1,000 would not be justifiable in respect of a class of policies which is the reverse of the by-product. The average amount per policy in these classes is doubtless much in excess of what the average non-medical policy will be, at least until a good deal of experience is obtained. Unless non-medical policies for amounts up to about the average of medical policies can be written, there would seem to be a danger of insurance being spread among the companies in a large number of small non-medical policies, thus increasing the expense. There is, of course, the possibility of insurance being written which would not otherwise be written, thus reducing expenses; but it would seem best not to count too much on the net expense saving, as it may prove a bit elusive, especially in the experimental stages. Reliance must be mainly placed on ability to get satisfactory mortality on the average.

It may add interest to this discussion to furnish the experience

of two Canadian friendly societies—the Civil Service Mutual Benefit Society, organized 1872, and the Post Office Department Mutual Benefit Society, organized 1879—which have always operated entirely on the non-medical basis with negligible exceptions in recent years. The experience prior to 1915 is not available. For the years 1915 to 1920, inclusive, the combined figures are as follows:

Age.	Exposed.	Actual Deaths.	Expected Deaths.	
			$C^{M(5)}$	N.F.C.
Under 20	60	—	.2	.4
20–30	1,647	17	7.2	8.7
30–40	1,678	9	7.7	10.4
40–50	1,151	2	8.1	10.2
50–60	873	11	12.5	13.5
60–70	460	15	16.2	15.9
70–80	160	16	12.5	12.4
80–90	54	12	10.1	11.1
Totals	6,083	82	74.5	82.6

DEATHS BY CALENDAR YEARS.

Year.	Deaths.
1915	11
1916	6
1917	15
1918	18
1919	18
1920	14
Total	82

No allowance was made for exposure in the calendar year of entry, so that the expected deaths are slightly understated. As will be seen from the above, the war and influenza had a decided effect. Making allowance for deaths from these causes would bring the expected within the $C^{M(5)}$.

One society issues certificates for $250 only; the other for $250 or $500. The larger certificate has been issued for nearly two and a half years, and there is no reason for thinking that the selection is not as good as for the smaller amount. There have been no $500 claims so far; there has never been a claim in the first year of membership. The society uses an application form calling for substantially the same information as is asked for by the ordinary form of companies, excluding the strictly professional portions of the examiner's report. Applications are considered by a board of laymen, and if this board is not satisfied that the applicant is in good health, he is asked to go to the medical examiner of the society. Practically none of them ever do so, and therefore the whole busi-

ness may be regarded as non-medical. Information seems to be accurately given in the applications and there appears to be no disposition to conceal.

MR. JOHN K. GORE:

The experiment being made by four or five Canadian companies in issuing policies for $1,000 without medical examination has been reported in the insurance journals, and we are fortunate in having presented today two papers on this interesting subject.

Many American companies have no doubt already given the question careful study. For more than twenty years the company with which I am associated has issued Industrial policies up to a certain amount without medical examination. At first this was done only in rural districts for amounts of insurance up to $200. The plan was gradually extended, however, to include all the company's territory except those States (this year reduced to one, Massachusetts) where a medical examination is required by law. The limit of amount has been increased from time to time to $500 up to age 35, the limit being graded downward with increasing age at issue. The mortality experience has been favorable. We have also been issuing on the same basis since about the middle of 1918 so-called Intermediate policies for $500 on the lives of men up to age 30, and since April, 1920, on the lives of men and unmarried women up to age 35. It is not possible as yet to determine the result of this latter innovation, partly because of the recent influenza epidemic and partly because of the short period during which the plan has been in operation. As far as we can judge, the extra mortality has been inconsiderable. A number of years must elapse, however, before it can be known whether or not the experiment is a success. It should be understood in this connection that both the Industrial policies referred to and the Intermediate policies are based upon their own standard mortality tables, which, of course, show considerably higher rates than the American Men table.

An important fact in connection with the issuing of Intermediate policies without medical examination is that the privilege is limited practically to our Industrial field men and does not apply to special agents who write Ordinary business only. The reason is apparent when it is explained that our Industrial agents have direct contracts with the company, while the special agents are employed by the Ordinary field managers, and therefore are not as closely in touch with the company as the Industrial men. Moreover, the Industrial agents are subject to a more direct supervision than the special agents. The latter, by the way, as a matter of fact, write very little Intermediate business.

When we come to consider the issuing in the United States of policies for $1,000 without medical examination, we are confronted with a number of conditions that may well make us hesitate. I should like to refer briefly to two or three of them.

In the first place, the population in England where the "Non-Medical" business seems to have become established is much less in a state of flux than in this country. There the history of an individual is on the average better known than in the United States, where, especially among those who apply for not more than $1,000 of insurance, the applicant is often practically unknown by his neighbors, thus placing at a disadvantage the life insurance company that must depend largely upon his own statements. This is especially true among the foreign born. While the population of Canada resembles in this respect that of the United States more closely than that of England, it is nevertheless not as transient as the population of this country. This problem, therefore, is a more serious one in the States than elsewhere.

Another phase of the question is that it can hardly be expected that all the life insurance companies of the United States would agree to the issuing of policies for $1,000 without medical examination. If they should do so, or if the companies doing, say, 80 per cent. of the total business of the country should do so, I believe the plan might safely be undertaken, assuming, as Mr. Kilgour suggests, that some satisfactory central information bureau could be established. I do not mean to imply, however, that I would favor the plan even under such conditions. Should a single company or even a comparatively few companies in this country adopt a "Non-Medical" plan, there would in a short time develop a two-fold selection against it or them. On the one hand a certain proportion of poor risks would seek and obtain standard insurance policies, and on the other hand many very desirable prospects, especially those wishing higher amounts of insurance, would under pressure from agents of rival "Medical" companies tend to avoid the company accepting unexamined lives. As a result there would be a higher percentage than normal of under-average risks and a smaller percentage of super-risks.

Among the "Non-Medical" companies it would be necessary for the soliciting agent to secure along with other similar information a record of the family history of the applicant. As pointed out by Mr. Kilgour, the probability of this record being reliable would undoubtedly be much less than if secured by a medical examiner. I remember reading in the *Proceedings of the Association of Life Insurance Medical Directors* (and this may be the case referred to by Mr. Kilgour) a statement by the medical director of a large company that his company tried the plan of having the agents obtain the family history of applicants. The results proved to be so unreliable that this record was retransferred to the medical examiner's blank.

I am inclined to think there would be more substitutions of specimens of urine if submitted by laymen than if submitted by medical men.

Two of the purposes of a medical examination are stated by Mr. Kilgour to be (1) the elimination of persons who know they are medically unfit and who desire to defraud the company; (2) the elimination of persons who are ignorant of their medical unfitness, but who nevertheless are below the standard of acceptance. A study of the causes of rejection makes it evident that many of both of the classes referred to would be admitted in "Non-Medical" companies. I omit here for the sake of brevity any analysis of these causes. Those that would be likely to escape detection in "Non-Medical" companies will reveal themselves to any one carefully considering the subject.

It would not seem practicable for a company issuing "Non-Medical" policies to make them less liberal than those of "Medical" companies. To do so or to maintain two separate classes, "Medical" and "Non-Medical," in one company would, of course, greatly increase adverse selection. In these days most companies offer the disability feature, and it would seem necessary for "Non-Medical" companies to do the same. Since the impairments which cause extra mortality are in part identical with the chief causes of disability, it would seem that an allowance should be made for extra disability claims as well as for extra death claims in considering this whole question.

Mr. Hunter has given us a valuable set of tables which will be useful to anyone endeavoring to forecast the results of adopting the "Non-Medical" plan. In view of the fact that it would be necessary to have Home Office urinalyses in all cases, and probably also mercantile reports, I am inclined to place the saving that would follow doing away with medical examination at $4 per $1,000 rather than $5. I am also inclined to believe that the effect of admitting a higher percentage of poor lives would last longer than ten years. I remember an investigation made in our company some years ago of the experience of 5,000 rejected lives which had previously been accepted. The mortality for the first five years was 200 per cent. of that expected by the American Experience table, and for the sixth to twenty-sixth years, inclusive, 158 per cent. For the tenth to the twenty-sixth years, inclusive, it was 132 per cent. The death rate among these lives was, of course, higher than would be expected among the under-average lives referred to above, but it may be that the tendency of both groups as to the duration of impairments would be the same.

We shall all be interested in the experiment being tried by the Canadian companies, although we can not expect to know the results for a number of years.

(ORAL DISCUSSION.)

MR. HENRY MOIR:

I expected to say something on this subject, but most of my ideas have been expressed by others; and, as the time is getting late, I shall omit much I would have said and merely refer to one or two points. One of the reasons why medical examinations were required in the past was, I think, that a check upon the agents might exist. In this country the tendency, in the solicitation of business, has been to make the application as simple and easy as possible, putting much of the work on the medical examiner in developing facts. If, therefore, the thought of writing insurance without medical examination were to progress, it would be necessary to reverse this tendency—indeed, practically to change the mental attitude of a great many agents. They think they have secured the case when they get the prospect to sign a preliminary form, the real questions being asked by the medical examiner.

My insurance history, as you know, goes back over the period when this question became a live issue in Great Britain, and I was in the midst of the discussion from 1890 to 1900. At that time I could not develop any warm sympathy with the views that were put forward to make the effecting of insurance easier for the applicant. I have never been able to see that that is a strong and telling argument; yet it was the main argument, as has been pointed out, put forward in support of the British plans of life insurance without medical examination. Moreover, these plans have apparently gone successfully.

On the other hand, the reasoning put before us now is very different. It is simply a question of extending the amount of insurance which a company may be willing to take without medical examination in order to save money. Therefore it is a question of calculation as to whether the amount saved will offset what is doubtless lost. The industrial companies are all—I think all—taking small amounts, usually up to $500, without medical examination; and all that we are now asked to consider is whether these amounts might not advantageously be extended to a thousand dollars.

The tables submitted by Mr. Hunter give some information in that direction, and it has occurred to me that another guide toward computing the loss from lack of medical examination may be obtained by examining the differences between the American Men Select Mortality and the Ultimate Mortality by the same table. The calculation at age 35 works out as follows:

1000 q_{35}	= 4.78	
1000 $q_{[35]}$	= 3.16	
Δ	=	1.62
1000 q_{36}	= 4.94	
1000 $q_{[35]+1}$	= 4.29	
Δ_{+1}	=	.65
Similarly, Δ_{+2}	=	.55
Δ_{+3}	=	.52
Δ_{+4}	=	.33
Total		3.67

This shows a loss from lack of selection of $3.67 per $1,000. The true loss is less, because it should be discounted at interest, and, moreover, the sum at risk is always less than $1,000, depending on the class of policy. Moreover, there are two other elements which are left out of the computation:

First, the question as to whether the ultimate mortality may not be affected by the initial selection or other factors; and

Second, the question as to whether the risks obtained without medical examination, since they include all classes, may not be *better* than the ultimate mortality by the American Men table.

The corresponding figures at ages 25 and 45 are 2.71 and 8.11, respectively.

We can get another viewpoint by considering the number of cases declined. As I have seen the business submitted to us, I believe that on the basis of an indiscriminate solicitation, from 15 to 20 per cent. of all cases submitted may be classed as doubtful. If an agency is educated in discriminative solicitation so that they do not submit cases that are seriously doubtful the percentage may be reduced to less than 10 per cent. If 10 per cent. represents the doubtful business, we can suppose—it is largely a guess—that such 10 per cent. of the business would be subject to, say, 200 per cent. *extra* mortality if taken. That would be 20 per cent. extra mortality over the entire business—20 per cent. per annum. That is an extra that few of us would care to face, but I am inclined to think that the suggested 200 per cent. extra is an exaggeration, and that after a few years the tendency to equilibrium would assert itself. It seems the extreme limit to which that mortality might go. In either case the movement, as an experiment, seems to have a reasonable justification, and facts will before many years prove or disprove the theories.

My viewpoint of insurance without medical examination is that the grip the company holds upon its agents is one of the most important elements. If its agents are well trained, have been long

in the service and are careful, honorable men, the danger incurred by the company is comparatively small, but business from temporary agents, or brokers, must certainly be cut out.

The question of duplication is an interesting one. I suppose that must be covered by the terms of the contract. The question is asked as to whether the applicant is applying elsewhere, and I presume that for two years his replies would be in the nature of warranties. If the answers are untruthful, the insurance could be contested as being obtained by fraud. I understand the Canadian law is different from ours on the question of indisputability, in that a policy may be disputed *after* two years on the ground of fraud. We here seem to be prevented from contesting a claim except during the first two years on any ground including fraud, a condition which is very objectionable.

MR. ARTHUR B. WOOD:

In the discussion thus far the impression would appear to have been conveyed that the scheme of non-medical examination is being adopted quite generally by the Canadian companies. As far as this continent is concerned, the plan may be called Canadian in that it originated in Canada, but thus far only five Canadian companies have adopted it, and they have been operating it only since the first of January last. The company with which I am connected, after careful consideration, decided not to adopt the scheme, although, as always happens when any new idea is being exploited, many of our agents strongly urged us to do so at the outset. We considered the question in the first instance purely from the standpoint of the saving in expense as an offset to the extra mortality to be expected, but concluded that the expense attached to the special safeguards which must naturally be adopted, such as inspection reports and probably a special bureau of information, would use up at least 50 per cent. of the medical fee.

I should mention that throughout a considerable section of Canada, in the Provinces of Quebec and Ontario practically entirely, the medical fee for one thousand dollars does not exceed four dollars and in some places is only three dollars. The gross saving would therefore be four dollars as a maximum. One dollar at least would be expended on the special inspection report, and the expenses attached to the bureau which it is proposed to establish would naturally be considerable. Consequently the saving would not be nearly as much as might at first thought be anticipated.

Then we considered the question from the standpoint of the possible effect upon the production of business. Our view was that it would tend to increase the number of one thousand dollar policies and probably reduce the average size of the policy without actually resulting in a greater volume of business. One can readily imagine

an applicant saying of the agent, "I would like to take one of those policies without medical examination," whereas if the company had not adopted the practice the agent might easily have secured his application for a larger amount.

At a meeting of our agency managers early in January the matter was discussed from every standpoint and the unanimous conclusion reached by them was that they did not want it. Since then there has been no demand from the agents.

We also gave some thought to what our experience would probably be as compared with the experience in Great Britain. We have been operating in Great Britain for many years, and from our inspection of the applications and medical reports I am inclined to believe that the average applicant in Great Britain gives us more full and accurate information regarding his personal and family history than we obtain from the average applicant on this continent. Our medical referees have frequently commented upon this as a distinct feature of our British business. The scheme of non-medical examination in Great Britain would therefore probably result in a more favorable mortality than on this continent. This, of course, is merely an impression.

It was also felt that unless the system were generally adopted by the majority of the companies operating in Canada there would tend to be a selection against those companies which did undertake it resulting in an unduly high mortality.

Another thought occurs to me in connection with a remark by our President as to the practice of one of the British companies in accepting under a non-medical examination scheme amounts up to as much as £15,000. It should be observed that the application form always contains a question asking for the name of the applicant's private physician, and an authorization is given by the applicant to the company to consult and obtain a report from his physician. Referring to the form of application attached to Mr. Kilgour's paper, the following is found in the declaration: "I expressly waive, in my name and that of any other person who shall have or claim an interest in any policy issued as a result of these answers, all provisions of law forbidding any physician or other person who has attended or examined me or who may hereafter attend or examine me from revealing any detail or knowledge which was acquired thereby." I understand that in connection with these large cases the companies take the precaution of consulting the applicant's private physician. This is also done in smaller cases, especially if any doubt exists as to the insurability of the applicant. This affords a considerable safeguard. I might mention that it is a common practice in Great Britain in connection with large cases where ordinarily two medical examinations would be required to have but one medical examination made by one of the company's regular examiners, and a second report is obtained

from the physician of the applicant. If this practice is followed in connection with the non-medical examination scheme, the company is protected, for it gets what is practically equivalent to a medical examination. When a report from the private medical attendant is desired, the practice is to forward him the usual examination fee of one guinea.

British companies, therefore, while nominally writing insurance without medical examination, are in reality obtaining a medical report in many instances and paying a fee for it.

The motive actuating the British companies is not to dispense with the services of the Medical Examiner, but rather to cater to the susceptibilities of a certain class of man, who, while believing himself to be a first-class risk, dislikes the idea of being subjected to a physical examination, but is quite willing that the company should obtain from his private physician all the information he is able to disclose.

MR. V. R. SMITH:

With regard to the points raised in the third last paragraph of Mr. Wood's discussion, our practice is to obtain a full medical examination if we have any information on hand which would lead us to believe that a medical opinion would be advisable on some particular point. Subsequently, we may ask for a statement from the applicant's private physician, but do so only in exceptional cases, in which event we pay the physician his fee. Therefore, it is a medical case, not a non-medical one, when we ask the applicant's physician for an opinion.

(AUTHORS' REPLY TO DISCUSSION.)

MR. D. E. KILGOUR:

In presenting this paper I had serious misgivings; in the first place because I had very little time at my disposal and in the second place because I felt there were others more competent to deal with the subject in an adequate way. However, it has amply served its purpose in evoking a general and comprehensive discussion. The subject is one which in its very nature one can not treat dogmatically, and if I have presented a rather conservative viewpoint, it has certainly not been the desire to belittle the work and efforts of those whose confidence and optimism I sincerely trust will be rewarded with success. There is little, if anything, that I can add at the present stage. While this kind of business is not new in Great Britain, it is undoubtedly an experiment in this country, where conditions on the whole are different.

The point has been made that in some of the outlying districts it is very difficult to get medical examiners. At the same time is it not true that in many such districts we should be slow to accept

business on any terms? In a recent trip through Western Canada the only agent who made a plea for life insurance without medical examination was one who worked occasionally in a section that was not properly served with medical men. I pointed out to him that in any event we should require an examination for larger amounts, and, further, that it was a question whether we should encourage business in sections of the country without adequate medical service. It is just in such sections of the country that epidemics take their greatest toll and where the mortality apart from other considerations would naturally be higher. In the case of women it is admittedly a convenience to do without the medical examination, but I am personally inclined to think that, with increasing business experience, the average woman is less reluctant today than she may once have been to submit herself to the ordinary medical examination. After all, I think we attach too much importance to women's supposed sensibilities. It has been said that the subject has been made a vital one in Canada on account of the increasing fees charged for medical examinations. It is true that a year ago there seemed to be likelihood that the companies would be forced to recognize the claims of medical examiners. Today much less is heard of this, and I am inclined to think that our Canadian companies will be able to get along very well on pretty much the same basis that has obtained in the past. Having regard to the scale of fees now in use, I do not believe that there will be any saving to the company. In fact, I am quite certain that the extra mortality likely to be experienced will much more than offset any initial saving. Experience alone will show whether there will be any increase in business brought about by elimination of a medical examination, and, if so, to what extent it will reduce the expenses. I agree with Mr. Moir and others that the character of the agents from whom this business is expected will be the determining factor in regard to the profitableness of the business. I am still doubtful if the average agency force is of the type to insure success. I am indebted to Mr. Reid for giving some useful supplementary information in connection with the conditions surrounding business here. These, obviously, should have been referred to in my paper.

In conclusion I wish to thank the members for the valuable information they have furnished and for the extremely useful and constructive criticism which they have given.

MR. ARTHUR HUNTER:

The sole purpose in presenting the figures in my Actuarial Note was to give an approximate idea of the extra mortality which $5 per thousand would cover. It seemed hardly necessary to state that there would be slight changes if the plan of insurance were taken into account. The method was chosen on account of its convenience. Experiments by the most accurate method showed that

the tables submitted were practically correct for Ordinary Life policies, and that the differences for 20 Payment and 20 Year Endowment were very small. The differences, of course, would be somewhat larger in case of short-term single premium endowments.

A number of tests were made to determine whether there would be any material change in the figures if the rates of lapse were taken into account. The changes thus involved are of minor importance and need not be considered seriously in view of our lack of knowledge with regard to the probable incidence of the extra mortality.

Central Difference Interpolation.

BY

R. HENDERSON.

It has been suggested that it would be a help to students and others if the text-books now available on the subject of Finite Differences were supplemented by a more complete statement of the formulas and methods of central difference interpolation. This paper is an effort to supply this need by bringing together some of the more important work that has been done recently on that subject and which is of a nature likely to be of value to the student and practical worker. No originality is claimed by the author of this paper for any of the methods here described. The object is merely to compile in systematic form what has already appeared elsewhere.

Notation.

The reader is assumed to be familiar with the ordinary finite difference notation according to which

$$\Delta u_x = u_{x+1} - u_x \tag{1}$$

and generally

$$\Delta^{n+1} u_x = \Delta^n u_{x+1} - \Delta^n u_x. \tag{2}$$

For the purposes of this paper the notation used for central differences will be that of Dr. Sheppard according to which

$$\delta u_x = u_{x+\frac{1}{2}} - u_{x-\frac{1}{2}} = \Delta u_{x-\frac{1}{2}} \tag{3}$$

and, generally,

$$\delta^{n+1} u_x = \delta^n u_{x+\frac{1}{2}} - \delta^n u_{x-\frac{1}{2}} = \Delta^{n+1} u_{x-\frac{n+1}{2}}. \tag{4}$$

Also

$$\mu\delta^n u_x = \tfrac{1}{2}(\delta^n u_{x-\frac{1}{2}} + \delta^n u_{x+\frac{1}{2}}) \tag{5}$$

and

$$\begin{aligned} \mu^2\delta^n u_x &= \tfrac{1}{2}(\mu\delta^n u_{x-\frac{1}{2}} + \mu\delta^n u_{x+\frac{1}{2}}) \\ &= \tfrac{1}{4}(\delta^n u_{x-1} + 2\delta^n u_x + \delta^n u_{x+1}) \\ &= \delta^n u_x + \tfrac{1}{4}\delta^{n+2} u_x. \end{aligned} \tag{6}$$

The successive differences of the function may accordingly be tabulated as follows:

$x.$	$u_x.$	1st.	2nd.	3rd.	4th.	5th.	6th.
-3	u_{-3}						
		$\delta u_{-2\frac{1}{2}}$					
-2	u_{-2}		$\delta^2 u_{-2}$				
		$\delta u_{-1\frac{1}{2}}$		$\delta^3 u_{-1\frac{1}{2}}$			
-1	u_{-1}		$\delta^2 u_{-1}$		$\delta^4 u_{-1}$		
		$\delta u_{-\frac{1}{2}}$		$\delta^3 u_{-\frac{1}{2}}$		$\delta^5 u_{-\frac{1}{2}}$	
0	u_0		$\delta^2 u_0$		$\delta^4 u_0$		$\delta^6 u_0$
		$\delta u_{\frac{1}{2}}$		$\delta^3 u_{\frac{1}{2}}$		$\delta^5 u_{\frac{1}{2}}$	
1	u_1		$\delta^2 u_1$		$\delta^4 u_1$		
		$\delta u_{1\frac{1}{2}}$		$\delta^3 u_{1\frac{1}{2}}$			
2	u_2		$\delta^2 u_2$				
		$\delta u_{2\frac{1}{2}}$					
3	u_3						

It will be noticed that each difference is set opposite the point corresponding to its suffix and midway between the two quantities of which it is the difference. The suffixes of the higher orders of differences are also seen to be the mean of those of the first and last of the terms of the original series which determine the difference.

This use of the symbol δ is to be carefully distinguished from that in Part II of the Text Book of the Institute of Actuaries where in one place it is used to denote subdivided forward differences.

From equations (4) and (5) we obtain directly the following:

$$\delta^n u_{x+\frac{1}{2}} = \mu\delta^n u_x + \tfrac{1}{2}\delta^{n+1} u_x, \tag{7}$$

$$\delta^n u_{x-\frac{1}{2}} = \mu\delta^n u_x - \tfrac{1}{2}\delta^{n+1} u_x. \tag{8}$$

Gauss's Formula.

The formula of Gauss is given in Art. 29 of Chapter XXIII of Part Two of the Text Book of the Institute of Actuaries but is there stated in a notation different from that here adopted. A comparison, however, of the tabulated differences enables us to translate the formula, as there given, into Dr. Sheppard's notation with the following result:

$$u_x = u_0 + x\delta u_{\frac{1}{2}} + \frac{x(x-1)}{\lfloor 2}\delta^2 u_0 + \frac{x(x^2-1)}{\lfloor 3}\delta^3 u_{\frac{1}{2}} + \frac{x(x^2-1)(x-2)}{\lfloor 4}\delta^4 u_0 + \frac{x(x^2-1)(x^2-4)}{\lfloor 5}\delta^5 u_{\frac{1}{2}} + \text{etc.} \tag{9}$$

This formula may be derived as follows:

The general expression for a rational algebraic function may be written in the form,

$$u_x = A_0 + (x - a)A_1 + (x - a)(x - b)A_2 + (x - a)(x - b)(x - c)A_3 + \text{etc.},$$

where the factors involving x in any term appear in every succeeding term with a new factor added at each step, a, b, c, etc. being any values of x. Then the first $(n + 1)$ terms of this series represent a function of the nth degree determined by the $(n + 1)$ values of u_x corresponding to the first $(n + 1)$ of the values a, b, c, etc. of x, since all the remaining terms vanish for each of those values of x. The coefficient of x^n in this limited function is A_n and the nth difference for unit intervals is accordingly $\lfloor\underline{n} A_n$. If then we designate by $\Delta^n(abc\cdots)$ this nth difference, we have

$$A_n = \frac{\Delta^n(abc\cdots)}{\lfloor\underline{n}}.$$

Therefore, since this is true for any value of n,

$$u_x = u_a + (x - a)\Delta_{(ab)} + \frac{(x - a)(x - b)}{\lfloor\underline{2}}\Delta^2_{(abc)} + \frac{(x - a)(x - b)(x - c)}{\lfloor\underline{3}}\Delta^3_{(abcd)} + \text{etc.} \quad (10)$$

If, then, we take for a, b, c, etc., the values 0, 1, -1, 2, -2, etc., the values taken in at any stage form a series with unit intervals and the nth difference is the nth central difference corresponding to the mean of the last two values of the variable which have been taken in since these two are the highest—and lowest—taken in up to that point. Making this latter substitution we obtain immediately equation (9).

If this formula is applied to systematic interpolation such as, for example, where each original interval is to be divided into five equal sub-intervals by the interpolation of four additional terms the best results are obtained by retaining an odd order of differences because we thus use the same number of terms on each side of the interval. Using fifth differences and, for the sake of brevity, designating $\delta u_x/5$, $\delta^2 u_x/5^2$, $\delta^3 u_x/5^3$, $\delta^4 u_x/5^4$ and $\delta^5 u_x/5^5$ by a_x, b_x, c_x, d_x and e_x respectively, we have the following results:

$$\left.\begin{aligned} u_{\frac{1}{5}} &= u_0 + a_{\frac{1}{2}} - 2b_0 - 4c_{\frac{1}{2}} + 9d_0 + 19.8e_{\frac{1}{2}}, \\ u_{\frac{2}{5}} &= u_0 + 2a_{\frac{1}{2}} - 3b_0 - 7c_{\frac{1}{2}} + 14d_0 + 33.6e_{\frac{1}{2}}, \\ u_{\frac{3}{5}} &= u_0 + 3a_{\frac{1}{2}} - 3b_0 - 8c_{\frac{1}{2}} + 14d_0 + 36.4e_{\frac{1}{2}}, \\ u_{\frac{4}{5}} &= u_0 + 4a_{\frac{1}{2}} - 2b_0 - 6c_{\frac{1}{2}} + 9d_0 + 25.2e_{\frac{1}{2}}, \\ u_1 &= u_0 + 5a_{\frac{1}{2}}, \end{aligned}\right\} \quad (11)$$

If we difference these interpolated values and use $\delta_1^n u_x$ to denote the nth central difference of the subdivided series corresponding to the value x of the variable, we have the following results:

$$\left.\begin{aligned}
\delta_1 u_{\frac{1}{10}} &= a_{\frac{1}{2}} - 2b_0 - 4c_{\frac{1}{2}} + 9d_0 + 19.8e_{\frac{1}{2}},\\
\delta_1 u_{\frac{3}{10}} &= a_{\frac{1}{2}} - b_0 - 3c_{\frac{1}{2}} + 5d_0 + 13.8e_{\frac{1}{2}},\\
\delta_1 u_{\frac{1}{2}} &= a_{\frac{1}{2}} - c_{\frac{1}{2}} + 2.8e_{\frac{1}{2}},\\
\delta_1 u_{\frac{7}{10}} &= a_{\frac{1}{2}} + b_0 + 2c_{\frac{1}{2}} - 5d_0 - 11.2e_{\frac{1}{2}},\\
\delta_1 u_{\frac{9}{10}} &= a_{\frac{1}{2}} + 2b_0 + 6c_{\frac{1}{2}} - 9d_0 - 25.2e_{\frac{1}{2}},
\end{aligned}\right\} \tag{12}$$

$$\left.\begin{aligned}
\delta_1^2 u_{\frac{1}{5}} &= b_0 + c_{\frac{1}{2}} - 4d_0 - 6e_{\frac{1}{2}},\\
\delta_1^2 u_{\frac{2}{5}} &= b_0 + 2c_{\frac{1}{2}} - 5d_0 - 11e_{\frac{1}{2}},\\
\delta_1^2 u_{\frac{3}{5}} &= b_0 + 3c_{\frac{1}{2}} - 5d_0 - 14e_{\frac{1}{2}},\\
\delta_1^2 u_{\frac{4}{5}} &= b_0 + 4c_{\frac{1}{2}} - 4d_0 - 14e_{\frac{1}{2}},
\end{aligned}\right\} \tag{13}$$

$$\left.\begin{aligned}
\delta_1^3 u_{\frac{3}{10}} &= c_{\frac{1}{2}} - d_0 - 5e_{\frac{1}{2}},\\
\delta_1^3 u_{\frac{1}{2}} &= c_{\frac{1}{2}} - 3e_{\frac{1}{2}},\\
\delta_1^3 u_{\frac{7}{10}} &= c_{\frac{1}{2}} + d_0,
\end{aligned}\right\} \tag{14}$$

$$\left.\begin{aligned}
\delta_1^4 u_{\frac{2}{5}} &= d_0 + 2e_{\frac{1}{2}},\\
\delta_1^4 u_{\frac{3}{5}} &= d_0 + 3e_{\frac{1}{2}},
\end{aligned}\right\} \tag{15}$$

$$\delta_1^5 u_{\frac{1}{2}} = e_{\frac{1}{2}}. \tag{16}$$

Since we assume that fifth differences are constant we have, if we suppose each order of difference filled in to the points of junction inclusive,

$$\left.\begin{aligned}
\delta_1^4 u_0 &= d_0\\
\delta_1^4 u_{\frac{1}{5}} &= d_0 + e_{\frac{1}{2}},\\
\delta_1^4 u_{\frac{2}{5}} &= d_0 + 4e_{\frac{1}{2}},\\
\delta_1^4 u_1 &= d_0 + 5e_{\frac{1}{2}} = d_1,
\end{aligned}\right\} \tag{17}$$

$$\left.\begin{aligned}
\delta_1^3 u_{\frac{1}{10}} &= \delta_1^3 u_{\frac{3}{10}} - \delta_1^4 u_{\frac{1}{5}},\\
&= c_{\frac{1}{2}} - 2d_0 - 6e_{\frac{1}{2}},\\
\delta_1^3 u_{\frac{9}{10}} &= \delta_1^3 u_{\frac{7}{10}} + \delta_1^4 u_{\frac{4}{5}},\\
&= c_{\frac{1}{2}} + 2d_0 + 4e_{\frac{1}{2}},
\end{aligned}\right\} \tag{16}$$

$$\left.\begin{aligned}
\delta_1^2 u_0 &= \delta_1^2 u_{\frac{1}{5}} - \delta_1^3 u_{\frac{1}{10}},\\
&= b_0 - 2d_0,\\
\delta_1^2 u_1 &= \delta_1^2 u_{\frac{4}{5}} + \delta_1^3 u_{\frac{9}{10}},\\
&= b_0 + 5c_{\frac{1}{2}} - 2d_0 - 10e_{\frac{1}{2}} = b_1 - 2d_1.
\end{aligned}\right\} \tag{17}$$

We have accordingly as a basis for the calculation of the interpolated values,

$$\left.\begin{aligned}
&\delta_1^5 u_{\frac{1}{2}} = e_{\frac{1}{2}},\\
&\delta_1^4 u_0 = d_0,\\
&\delta_1^3 u_{\frac{1}{2}} = c_{\frac{1}{2}} - 3e_{\frac{1}{2}},\\
&\delta_1^2 u_0 = b_0 - 2d_0,\\
&\delta_1 u_{\frac{1}{2}} = a_{\frac{1}{2}} - c_{\frac{1}{2}} + 2.8e_{\frac{1}{2}} = a_{\frac{1}{2}} - \delta_1^3 u_{\frac{1}{2}} - \tfrac{1}{5}\delta_1^5 u_{\frac{1}{2}}.
\end{aligned}\right\} \qquad (18)$$

To illustrate the practical application of this formula let us take the series determined by the equation $u_x = 4^{3-x} \cdot 9^{x+2}$ and having given u_{-2}, u_{-1}, u_0, u_1, u_2 and u_3 interpolate four terms between u_0 and u_1. The given terms and their differences are:

x.	u_x.	δ.	δ^2.	δ^3.	δ^4.	δ^5.
− 2	1024					
		1280				
− 1	2304		1600			
		2880		2000		
0	5184		3600		2500	
		6480		4500		3125
1	11664		8100		5625	
		14580		10125		
2	26244		18225			
		32805				
3	59049					

Then we have,

$$\begin{aligned}
a_{\frac{1}{2}} &= 1296,\\
b_0 &= 144,\\
b_1 &= 324,\\
c_{\frac{1}{2}} &= 36,\\
d_0 &= 4,\\
d_1 &= 9,\\
e_{\frac{1}{2}} &= 1.
\end{aligned}$$

Hence,

$$\begin{aligned}
&\delta_1^5 u_{\frac{1}{2}} = 1,\\
&\delta_1^4 u_0 = 4;\ \delta_1^4 u_1 = 9,\\
&\delta_1^3 u_{\frac{1}{2}} = 36 - 3 = 33,\\
&\delta_1^2 u_0 = 144 - 8 = 136;\ \delta_1^2 u_1 = 324 - 18 = 306,\\
&\delta_1 u_{\frac{1}{2}} = 1296 - 33 - \cdot 2 = 1262 \cdot 8.
\end{aligned}$$

The following schedule shows the interpolated values and the differences used in calculating them. To the values other than those already determined are appended numbers in brackets to indicate the order in which they are determined

x	u_x	δ_1	δ_1^2	δ_1^3	δ_1^4
0	5184.		136		4
		919.8(14)		22(6)	
$\frac{1}{5}$	6103.8(17)		158(9)		5(1)
		1077.8(13)		27(5)	
$\frac{2}{5}$	7181.6(18)		185(10)		6(2)
		1262.8		33	
$\frac{3}{5}$	8444.4(19)		218(11)		7(3)
		1480.8(15)		40(7)	
$\frac{4}{5}$	9925.2(20)		258(12)		8(4)
		1738.8(16)		48(8)	
1	11664.		306		

It will be noticed that it was not necessary, except for checking purposes, to calculate $\delta_1^2 u_1$ and $\delta_1^4 u_1$ nor the differences numbered 3, 4, 7, 8, 12 and 16. Had fourth and fifth differences been neglected the schedule would have been as follows:

x	u_x	δ_1	δ_1^2
0	5184		144
		864(6)	
$\frac{1}{5}$	6048(9)		180(1)
		1044(5)	
$\frac{2}{5}$	7092(10)		216(2)
		1260	
$\frac{3}{5}$	8352(11)		252(3)
		1512(7)	
$\frac{4}{5}$	9864(12)		288(4)
		1800(8)	
1	11664		324

In this example the neglecting of fourth and fifth differences makes a considerable difference in the interpolated values because those differences in the original series are large. In cases ordinarily met with those differences will be smaller and the error introduced by neglecting them proportionately reduced.

If it is required to determine $u_{\frac{1}{2}}$ we have, putting $x = \frac{1}{2}$ in equation (9),

$$u_{\frac{1}{2}} = u_0 + \tfrac{1}{2}\delta u_{\frac{1}{2}} - \tfrac{1}{8}\delta^2 u_0 - \tfrac{1}{16}\delta^3 u_{\frac{1}{2}} + \tfrac{3}{128}\delta^4 u_0 + \tfrac{3}{256}\delta^5 u_2$$
$$= \mu u_{\frac{1}{2}} - \tfrac{1}{8}\mu\delta^2 u_{\frac{1}{2}} + \tfrac{3}{128}\mu\delta^4 u_{\frac{1}{2}}. \quad (19)$$

Newton-Stirling Formula.

From equation (7) putting $x = 0$, we have

$$\delta^n u_{\frac{1}{2}} = \mu\delta^n u_0 + \tfrac{1}{2}\delta^{n+1} u_0. \tag{20}$$

Substituting this value in (9) it becomes

$$u_x = u_0 + x(\mu\delta u_0 + \tfrac{1}{2}\delta^2 u_0) + \frac{x(x-1)}{\underline{|2}}\delta^2 u_0$$
$$+ \frac{x(x^2-1)}{\underline{|3}}(\mu\delta^3 u_0 + \tfrac{1}{2}\delta^4 u_0) + \frac{x(x^2-1)(x-2)}{\underline{|4}}\delta^4 u_0 + \text{etc.},$$
$$= u_0 + x\mu\delta u_0 + \frac{x^2}{\underline{|2}}\delta^2 u_0 + \frac{x(x^2-1)}{\underline{|3}}\mu\delta^3 u_0$$
$$+ \frac{x^2(x^2-1)}{\underline{|4}}\delta^4 u_0 + \text{etc.} \tag{21}$$

This is Newton's first central difference formula, also known as Stirling's formula. It may be seen, from the method of derivation here given, that when carried to an even order of differences it is equivalent to Gauss's formula carried to the same order. It is not generally used for systematic interpolation but is useful for determining an isolated interpolated value near to one of the given values. It might, however, be used for the insertion of a term on each side of each pivotal term, leaving the remaining terms to be inserted otherwise. For example, if four terms are to be interpolated in each interval thus subdividing it into five smaller intervals we have, to second differences,

$$u_{\frac{1}{5}} = u_0 + \frac{\mu\delta u_0}{5} + \tfrac{1}{2}\frac{\delta^2 u_0}{5^2} = u_0 + \frac{\delta u_{\frac{1}{2}}}{5} - 2\frac{\delta^2 u_0}{5^2}$$
$$= u_0 + a_{\frac{1}{2}} - 2b_0. \tag{22}$$

$$u_{-\frac{1}{5}} = u_0 - \frac{\mu\delta u_0}{5} + \tfrac{1}{2}\frac{\delta^2 u_0}{5^2} = u_0 - \frac{\delta u_{-\frac{1}{2}}}{5} - 2\frac{\delta^2 u_0}{5^2}$$
$$= u_0 - a_{-\frac{1}{2}} - 2b_0. \tag{23}$$

Hence, increasing all suffixes by unity

$$u_{\frac{4}{5}} = u_1 - a_{\frac{1}{2}} - 2b_1 = u_0 + 4a_{\frac{1}{2}} - 2b_1, \tag{24}$$

since $u_1 = u_0 + 5a_{\frac{1}{2}}$. If then we determine $u_{\frac{2}{5}}$ and $u_{\frac{3}{5}}$ from the condition that the corresponding fourth central differences in the interpolated series should vanish we have,

$$6u_{\frac{3}{5}} - 4u_{\frac{2}{5}} = 4u_{\frac{1}{5}} - u_0 - u_{\frac{4}{5}} = 2u_0 - 8b_0 + 2b_1,$$
$$6u_{\frac{3}{5}} - 4u_{\frac{3}{5}} = 4u_{\frac{2}{5}} - u_1 - u_{\frac{1}{5}} = 2u_0 + 10a_{\frac{1}{2}} - 8b_1 + 2b_0.$$

Hence,

$$u_{\frac{2}{5}} = u_0 + 2a_{\frac{1}{2}} - 2b_0 - b_1, \tag{25}$$
$$u_{\frac{3}{5}} = u_0 + 3a_{\frac{1}{2}} - b_0 - 2b_1. \tag{26}$$

Newton-Bessel Formula.

From equation (8), by putting $x = \frac{1}{2}$, we have,

$$\delta^n u_0 = \mu\delta^n u_{\frac{1}{2}} - \tfrac{1}{2}\delta^{n+1}u_{\frac{1}{2}}. \tag{27}$$

Substituting this value in (9), it becomes

$$\begin{aligned} u_x &= u_0 + x\delta u_{\frac{1}{2}} + \frac{x(x-1)}{\lfloor 2} (\mu\delta^2 u_{\frac{1}{2}} - \tfrac{1}{2}\delta^3 u_{\frac{1}{2}}) + \frac{x(x^2-1)}{\lfloor 3}\delta^3 u_{\frac{1}{2}} \\ &\quad + \frac{x(x^2-1)(x-2)}{\lfloor 4} (\mu\delta^4 u_{\frac{1}{2}} - \tfrac{1}{2}\delta^5 u_{\frac{1}{2}}) \\ &\quad + \frac{x(x^2-1)(x^2-4)}{\lfloor 5}\delta^5 u_{\frac{1}{2}} + \text{etc.}, \\ &= u_0 + x\delta u_{\frac{1}{2}} + \frac{x(x-1)}{\lfloor 2}\mu\delta^2 u_{\frac{1}{2}} + \frac{x(x-1)(x-\frac{1}{2})}{\lfloor 2}\delta^3 u_{\frac{1}{2}} \\ &\quad + \frac{x(x^2-1)(x-2)}{\lfloor 4}\mu\delta^4 u_{\frac{1}{2}} \\ &\quad + \frac{x(x^2-1)(x-2)(x-\frac{1}{2})}{\lfloor 5}\delta^5 u_{\frac{1}{2}} + \text{etc.} \end{aligned} \tag{28}$$

This is Newton's second central difference formula, also known as Bessel's formula. If taken to an odd order of differences it is equivalent to Gauss's formula taken to the same order. Since the differences entering into the formula correspond to the middle of the interval the formula is one well adapted for use in systematic interpolation or subdivision of intervals. Equation (19) giving the value of $u_{\frac{1}{2}}$ might, in fact, have been derived from equation (28) by putting x equal to $\frac{1}{2}$.

In the case of systematic interpolation by fifths, we have, from equation (28) using the abbreviated notation of equations (11) to (18),

$$\left.\begin{aligned} u_{\frac{1}{5}} &= u_0 + a_{\frac{1}{2}} - 2\mu b_{\frac{1}{2}} + c_{\frac{1}{2}} + 9\mu d_{\frac{1}{2}} - 2.7e_{\frac{1}{2}}, \\ u_{\frac{2}{5}} &= u_0 + 2a_{\frac{1}{2}} - 3\mu b_{\frac{1}{2}} + \tfrac{1}{2}c_{\frac{1}{2}} + 14\mu d_{\frac{1}{2}} - 1.4e_{\frac{1}{2}}, \\ u_{\frac{3}{5}} &= u_0 + 3a_{\frac{1}{2}} - 3\mu b_{\frac{1}{2}} - \tfrac{1}{2}c_{\frac{1}{2}} + 14\mu d_{\frac{1}{2}} + 1.4e_{\frac{1}{2}}, \\ u_{\frac{4}{5}} &= u_0 + 4a_{\frac{1}{2}} - 2\mu b_{\frac{1}{2}} - c_{\frac{1}{2}} + 9\mu d_{\frac{1}{2}} + 2.7e_{\frac{1}{2}}, \\ u_1 &= u_0 + 5a_{\frac{1}{2}}. \end{aligned}\right\} \tag{29}$$

And differencing as before

$$\left.\begin{aligned}
\delta_1 u_{\frac{1}{10}} &= a_{\frac{1}{2}} - 2\mu b_{\frac{1}{2}} + c_{\frac{1}{2}} + 9\mu d_{\frac{1}{2}} - 2.7e_{\frac{1}{2}}, \\
\delta_1 u_{\frac{3}{10}} &= a_{\frac{1}{2}} - \mu b_{\frac{1}{2}} - \tfrac{1}{2}c_{\frac{1}{2}} + 5\mu d_{\frac{1}{2}} + 1.3e_{\frac{1}{2}}, \\
\delta_1 u_{\frac{1}{2}} &= a_{\frac{1}{2}} - c_{\frac{1}{2}} + 2.8e_{\frac{1}{2}}, \\
\delta_1 u_{\frac{7}{10}} &= a_{\frac{1}{2}} + \mu b_{\frac{1}{2}} - \tfrac{1}{2}c_{\frac{1}{2}} - 5\mu d_{\frac{1}{2}} + 1.3e_{\frac{1}{2}}, \\
\delta_1 u_{\frac{9}{10}} &= a_{\frac{1}{2}} + 2\mu b_{\frac{1}{2}} + c_{\frac{1}{2}} - 9\mu d_{\frac{1}{2}} - 2.7e_{\frac{1}{2}},
\end{aligned}\right\} \quad (30)$$

$$\left.\begin{aligned}
\delta_1^2 u_{\frac{1}{5}} &= \mu b_{\frac{1}{2}} - \tfrac{3}{2}c_{\frac{1}{2}} - 4\mu d_{\frac{1}{2}} + 4.0e_{\frac{1}{2}}, \\
\delta_1^2 u_{\frac{2}{5}} &= \mu b_{\frac{1}{2}} - \tfrac{1}{2}c_{\frac{1}{2}} - 5\mu d_{\frac{1}{2}} + 1.5e_{\frac{1}{2}}, \\
\delta_1^2 u_{\frac{3}{5}} &= \mu b_{\frac{1}{2}} + \tfrac{1}{2}c_{\frac{1}{2}} - 5\mu d_{\frac{1}{2}} - 1.5e_{\frac{1}{2}}, \\
\delta_1^2 u_{\frac{4}{5}} &= \mu b_{\frac{1}{2}} + \tfrac{3}{2}c_{\frac{1}{2}} - 4\mu d_{\frac{1}{2}} - 4.0e_{\frac{1}{2}},
\end{aligned}\right\} \quad (31)$$

$$\left.\begin{aligned}
\delta_1^3 u_{\frac{3}{10}} &= c_{\frac{1}{2}} - \mu d_{\frac{1}{2}} - 2.5e_{\frac{1}{2}}, \\
\delta_1^3 u_{\frac{1}{2}} &= c_{\frac{1}{2}} - 3.0e_{\frac{1}{2}}, \\
\delta_1^3 u_{\frac{7}{10}} &= c_{\frac{1}{2}} + \mu d_{\frac{1}{2}} - 2.5e_{\frac{1}{2}},
\end{aligned}\right\} \quad (32)$$

$$\left.\begin{aligned}
\delta_1^4 u_{\frac{2}{5}} &= \mu d_{\frac{1}{2}} - \tfrac{1}{2}e_{\frac{1}{2}}, \\
\delta_1^4 u_{\frac{3}{5}} &= \mu d_{\frac{1}{2}} + \tfrac{1}{2}e_{\frac{1}{2}},
\end{aligned}\right\} \quad (33)$$

$$\delta_1^5 u_{\frac{1}{2}} = e_{\frac{1}{2}}, \quad (34)$$

so that we have,

$$\left.\begin{aligned}
\delta_1^5 u_{\frac{1}{2}} &= e_{\frac{1}{2}}, \\
\mu_1\delta_1^4 u_{\frac{1}{2}} &= \mu d_{\frac{1}{2}}, \\
\delta_1^3 u_{\frac{1}{2}} &= c_{\frac{1}{2}} - 3e_{\frac{1}{2}}, \\
\mu_1\delta_1^2 u_{\frac{1}{2}} &= \mu b_{\frac{1}{2}} - 5\mu d_{\frac{1}{2}}, \\
\delta_1 u_{\frac{1}{2}} &= a_{\frac{1}{2}} - c_{\frac{1}{2}} + 2.8e_{\frac{1}{2}} = a_{\frac{1}{2}} - \delta_1^3 u_{\frac{1}{2}} - \tfrac{1}{5}\delta_1^5 u_{\frac{1}{2}}.
\end{aligned}\right\} \quad (35)$$

In the numerical example used in connection with Gauss's formula we would have

$$\begin{aligned}
\delta_1^5 u_{\frac{1}{2}} &= e_{\frac{1}{2}} = 1, \\
\mu_1\delta_1^4 u_{\frac{1}{2}} &= \tfrac{1}{2}(d_0 + d_1) = 6.5, \\
\delta_1^4 u_{\frac{2}{5}} &= \tfrac{1}{2}(d_0 + d_1 - e_{\frac{1}{2}}) = 6, \\
\delta_1^4 u_{\frac{3}{5}} &= \tfrac{1}{2}(d_0 + d_1 + e_{\frac{1}{2}}) = 7, \\
\delta_1^3 u_{\frac{1}{2}} &= c_{\frac{1}{2}} - 3e_{\frac{1}{2}} = 36 - 3 = 33, \\
\mu_1\delta_1^2 u_{\frac{1}{2}} &= \tfrac{1}{2}\{(b_0 - 5d_0) + (b_1 - 5d_1)\} = \tfrac{1}{2}(124 + 279) = 201.5, \\
\delta_1^2 u_{\frac{2}{5}} &= \mu\delta_1^2 u_{\frac{1}{2}} - \tfrac{1}{2}\delta_1^3 u_{\frac{1}{2}} = \tfrac{1}{2}(124 + 279 - 33) = 185, \\
\delta_1^2 u_{\frac{3}{5}} &= \mu\delta_1^2 u_{\frac{1}{2}} + \tfrac{1}{2}\delta_1^3 u_{\frac{1}{2}} = \tfrac{1}{2}(124 + 279 + 33) = 218, \\
\delta_1 u_{\frac{1}{2}} &= 1296 - 33 - .2 = 1262.8.
\end{aligned}$$

The following schedule shows the interpolated values and the work of calculating them. Opposite 0 and 1 in the second differ-

ence column are set down the values of $b_0 - 5d_0$ and $b_1 - 5d_1$, respectively. To the differences are appended numbers in brackets to indicate the order in which they are determined.

x.	u_x.	δ_1.	δ_1^2.	δ_1^3.	δ_1^4.
0	5184		124		4
		$919.8_{(10)}$			
$\frac{1}{5}$	$6103.8_{(13)}$		$158_{(7)}$		
		$1077.8_{(9)}$		$27_{(5)}$	
$\frac{2}{5}$	$7181.6_{(14)}$		$185_{(3)}$		$6_{(1)}$
		1262.8		33	
$\frac{3}{5}$	$8444.4_{(15)}$		$218_{(4)}$		$7_{(2)}$
		$1480.8_{(11)}$		$40_{(6)}$	
$\frac{4}{5}$	$9925.2_{(16)}$		$258_{(8)}$		
		$1738.8_{(12)}$			
1	11664.		279		9

This method does not require the filling in of quite so many differences as does that described under Gauss's formula but the calculation of the differences used as a starting point is rather more complicated so that the choice between the two is to a certain extent a matter of personal preference.

The equations and illustrative example have been given to fifth differences inclusive. If the higher of these orders of differences are to be neglected no modification is necessary except to put zero for the differences so neglected. Equations (18) give the same result as equations (35) if both are carried to an odd order of differences but not if carried to an even order, since the mean value of the last difference would be used in (35) and the initial value in (18).

Everett's Formula.

Exactly the same interpolated values as result from the Newton-Bessel formula or Gauss's formula to an odd order of differences, may be arrived at by a method proposed by Professor Everett which will be more satisfactory to many workers.

Returning to equation (9) and putting $\delta^{n+1}u_{\frac{1}{2}} = \delta^n u_1 - \delta^n u_0$ we have, where $1 - x = y$,

$$u_x = u_0 + x(u_1 - u_0) + \frac{x(x-1)}{\lfloor 2} \delta^2 u_0 + \frac{x(x^2-1)}{\lfloor 3} (\delta^2 u_1 - \delta^2 u_0)$$

$$+\frac{x(x^2-1)(x-2)}{\underline{|4}}\delta^4u_0+\frac{x(x^2-1)(x^2-4)}{\underline{|5}}(\delta^4u_1-\delta^4u_0)$$

$$+\text{etc.},$$

$$=xu_1+(1-x)u_0+\frac{x(x^2-1)}{\underline{|3}}\delta^2u_1+\frac{x(x-1)(2-x)}{\underline{|3}}\delta^2u_0$$

$$+\frac{x(x^2-1)(x^2-4)}{\underline{|5}}\delta^4u_1+\frac{x(x^2-1)(x-2)(3-x)}{\underline{|5}}\delta^4u_0$$

$$+\text{etc.}$$

$$=yu_0+\frac{y(y^2-1)}{\underline{|3}}\delta^2u_0+\frac{y(y^2-1)(y^2-4)}{\underline{|5}}\delta^4u_0+\text{etc.},$$

$$+xu_1+\frac{x(x^2-1)}{\underline{|3}}\delta^2u_1+\frac{x(x^2-1)(x^2-4)}{\underline{|5}}\delta^4u_1+\text{etc.} \tag{36}$$

If then we write $\varphi(n:x)$ for

$$xu_{n+1}+\frac{x(x^2-1)}{\underline{|3}}\delta^2u_{n+1}+\frac{x(x^2-1)(x^2-4)}{\underline{|5}}\delta^4u_{n+1}+\text{etc.},$$

where n is integral and x is a positive proper fraction, we have,

$$u_{n+x}=\varphi(n:x)+\varphi(\overline{n-1}:\overline{1-x}). \tag{37}$$

This relation reduces the labor of calculating the interpolated terms since in general each calculated value of $\varphi(n:x)$ serves a double purpose.

For interpolation in fives the coefficients of $\delta^2u_1/5^2$ and $\delta^4u_1/5^4$ or of b_1 and d_1 in $\varphi(0:x)$ are as follows:

Coefficient of

x.	b_1.	d_1.
$\frac{1}{5}$	− .8	+ 3.96
$\frac{2}{5}$	− 1.4	+ 6.72
$\frac{3}{5}$	− 1.6	+ 7.28
$\frac{4}{5}$	− 1.2	+ 5.04

It will be noted from the foregoing that while it explicitly extends to an even order of differences, Everett's formula is really equivalent to Gauss's formula and hence to the Newton-Bessel formula carried to the next higher order.

The following example shows the application of this formula to third differences to the numerical example already quoted:

$n+x$.	xu_{n+1}.	$\frac{x(x^2-1)}{\lfloor 3}\delta^2 u_{n+1}$.	$\varphi(n:x)$.	$\varphi(\overline{n-1}:\overline{1-x})$.	u_{n+x}.
$-\frac{4}{5}$	1036.8	− 115.2	921.6		
$-\frac{3}{5}$	2073.6	− 201.6	1872.0		
$-\frac{2}{5}$	3110.4	− 230.4	2880.0		
$-\frac{1}{5}$	4147.2	− 172.8	3974.4		
0	5184	(144)	5184.0		5184
$\frac{1}{5}$	2332.8	− 259.2	2073.6	3974.4	6048
$\frac{2}{5}$	4665.6	− 453.6	4212.0	2880.0	7092
$\frac{3}{5}$	6998.4	− 518.4	6480.0	1872.0	8352
$\frac{4}{5}$	9331.2	− 388.8	8942.4	921.6	9864
1	11664	(324)	11664.0		11664

Differential Coefficients.

Since these various expressions for the interpolated value of u_x are rational algebriac functions of x the formation of the successive differential coefficients of u_x with respect to x is comparatively simple, consisting in the repeated application of the relation

$$\frac{dx^n}{dx} = nx^{n-1}.$$

From the Newton-Stirling formula, we have

$$\frac{du_x}{dx} = \mu\delta u_0 + x\delta u_0 + \frac{3x^2-1}{6}\mu\delta^3 u_0 + \frac{4x^3-2x}{24}\delta^4 u_0 + \text{etc.}, \quad (38)$$

$$\frac{d^2u_x}{dx^2} = \delta^2 u_0 + x\mu\delta^3 u_0 + \frac{12x^2-2}{24}\delta^4 u_0 + \text{etc.} \quad (39)$$

Hence,

$$\frac{du_0}{dx} = \mu\delta u_0 - \tfrac{1}{6}\mu\delta^3 u_0 + \text{etc.}, \quad (40)$$

$$\frac{d^2u_0}{dx^2} = \delta^2 u_0 - \tfrac{1}{12}\delta^4 u_0 + \text{etc.} \quad (41)$$

Or increasing all subscripts by unity,

$$\frac{du_1}{dx} = \mu\delta u_1 - \tfrac{1}{6}\mu\delta^3 u_1 + \text{etc.}, \quad (42)$$

$$\frac{d^2u_1}{dx^2} = \delta^2 u_1 - \tfrac{1}{12}\delta^4 u_1 + \text{etc.} \quad (43)$$

From the Newton-Bessel formula, we have

$$\frac{du_x}{dx} = \delta u_{\frac{1}{2}} + \frac{2x-1}{2}\mu\delta^2 u_{\frac{1}{2}} + \frac{3x^2-3x+\frac{1}{2}}{6}\delta^3 u_{\frac{1}{2}} + \frac{4x^3-6x^2-2x+2}{24}\mu\delta^4 u_{\frac{1}{2}} + \frac{5x^4-10x^3+5x-1}{120}\delta^5 u_{\frac{1}{2}} + \text{etc.}, \quad (44)$$

$$\frac{d^2u_x}{dx^2} = \mu\delta^2 u_{\frac{1}{2}} + (x - \tfrac{1}{2})\delta^3 u_{\frac{1}{2}} + \frac{12x^2 - 12x - 2}{24}\mu\delta^4 u_{\frac{1}{2}} + \frac{20x^3 - 30x^2 + 5}{120}\delta^5 u_{\frac{1}{2}} + \text{etc.} \quad (45)$$

Hence,

$$\frac{du_0}{dx} = \delta u_{\frac{1}{2}} - \tfrac{1}{2}\mu\delta^2 u_{\frac{1}{2}} + {}_{\frac{1}{2}}^{1}\delta^3 u_{\frac{1}{2}} + {}_{\frac{1}{2}}^{1}\mu\delta^4 u_{\frac{1}{2}} - {}_{\frac{1}{2}\,0}^{1}\delta^5 u_{\frac{1}{2}} + \text{etc.}, \quad (46)$$

$$\frac{du_1}{dx} = \delta u_{\frac{1}{2}} + \tfrac{1}{2}\mu\delta^2 u_{\frac{1}{2}} + {}_{\frac{1}{2}}^{1}\delta^3 u_{\frac{1}{2}} - {}_{\frac{1}{2}}^{1}\mu\delta^4 u_{\frac{1}{2}} - {}_{\frac{1}{2}\,0}^{1}\delta^5 u_{\frac{1}{2}} + \text{etc.}, \quad (47)$$

$$\frac{du_{\frac{1}{2}}}{dx} = \delta u_{\frac{1}{2}} - {}_{2\,4}^{1}\delta^3 u_{\frac{1}{2}} + {}_{6\,4\,0}^{3}\delta^5 u_{\frac{1}{2}} - \text{etc.}, \quad (48)$$

$$\frac{d^2u_0}{dx^2} = \mu\delta^2 u_{\frac{1}{2}} - \tfrac{1}{2}\delta^3 u_{\frac{1}{2}} - {}_{\frac{1}{2}}^{1}\mu\delta^4 u_{\frac{1}{2}} + {}_{2\,4}^{1}\delta^5 u_{\frac{1}{2}} + \text{etc.}, \quad (49)$$

$$\frac{d^2u_1}{dx_{\frac{1}{2}}} = \mu\delta^2 u_{\frac{1}{2}} + \tfrac{1}{2}\delta^3 u_{\frac{1}{2}} - {}_{\frac{1}{2}}^{1}\mu\delta^4 u_{\frac{1}{2}} - {}_{2\,4}^{1}\delta^5 u_{\frac{1}{2}} + \text{etc.}, \quad (50)$$

$$\frac{d^2u_{\frac{1}{2}}}{dx^2} = \mu\delta^2 u_{\frac{1}{2}} - {}_{2\,4}^{5}\mu\delta^4 u_{\frac{1}{2}} + \text{etc.} \quad (51)$$

Osculatory Interpolation.

In equations (46) and (49) the differential coefficients of u_0 are derived from the series for the interval 0 to + 1. We may obtain the values of the same coefficients as derived from the series for the interval − 1 to 0 by reducing each subscript in equations (47) and (50) by unity. The results are

$$\frac{du_0}{dx} = \delta u_{-\frac{1}{2}} + \tfrac{1}{2}\mu\delta^2 u_{-\frac{1}{2}} + {}_{1\,2}^{1}\delta^3 u_{-\frac{1}{2}} - {}_{1\,2}^{1}\mu\delta^4 u_{-\frac{1}{2}} - {}_{1\,2\,0}^{1}\delta^5 u_{-\frac{1}{2}} + \text{etc.}, \quad (52)$$

$$\frac{d^2u_0}{dx^2} = \mu\delta^2 u_{-\frac{1}{2}} + \tfrac{1}{2}\delta^3{}_{-\frac{1}{2}} - {}_{\frac{1}{2}}^{1}\mu\delta^4 u_{-\frac{1}{2}} - {}_{2\,4}^{1}\delta^5 u_{-\frac{1}{2}} + \text{etc.} \quad (53)$$

The values of the first differential coefficient will not be continuous at the point of junction of the two series unless its value as derived from equation (46) is equal to that derived from equation (52) and the amount of discontinuity is measured by the difference between these two values. This difference is

$$\delta^2 u_0 - \mu^2\delta^2 u_0 + {}_{1\,2}^{1}\delta^4 u_0 + \tfrac{1}{6}\mu^2\delta^4 u_0 - {}_{1\,2\,0}^{1}\delta^6 u_0 + \text{etc.},$$
$$= \delta^2 u_0 - (\delta^2 u_0 + \tfrac{1}{4}\delta^4 u_0) + {}_{1\,2}^{1}\delta^4 u_0 + \tfrac{1}{6}(\delta^4 u_0 + \tfrac{1}{4}\delta^6 u_0) - {}_{1\,2\,0}^{1}\delta^6 u_0 + \text{etc.} \quad (54)$$

In this expression the terms arising from the same order of differences in the original formula have been bracketed in order to study the effect on the discontinuity of including successive orders of differences. The following table shows the discontinuity for each order of differences:

Order of Differences.	Discontinuity of $\frac{du_x}{dx}$
1st	$+\ \delta^2 u_0$
2d	$-\ \frac{1}{4}\delta^4 u_0$
3d	$-\ \frac{1}{6}\delta^4 u_0$
4th	$+\ \frac{1}{24}\delta^6 u_0$
5th	$+\ \frac{1}{30}\delta^6 u_0$

The discontinuity in the values of $\frac{d^2u_x}{dx^2}$ is the difference between the value from equation (49) and that from (53). This difference is

$$\mu\delta^3 u_0 - \mu\delta^3 u_0 - \tfrac{1}{12}\mu\delta^5 u_0 + \tfrac{1}{12}\mu\delta^5 u_0. \qquad (55)$$

This may be tabulated as follows:

Order of Differences.	Discontinuity of $\frac{d^2u_x}{dx^2}$
1st	0
2d	$+\ \mu\delta^3 u_0$
3d	0
4th	$-\ \frac{1}{12}\mu\delta^5 u_0$
5th	0

Methods of interpolation designed to overcome to a greater or less degree this discontinuity are called *osculatory* methods. The first proposed and the most complete is that of Dr. Sprague but other simpler but less exact formulas will be first taken up.

Karup's Formula.

If in the Newton-Bessel formula to third differences we substitute $\mu B_{\frac{1}{2}}$ for $\mu\delta^2 u_{\frac{1}{2}}$ and $C_{\frac{1}{2}}$ for $\delta^3 u_{\frac{1}{2}}$ we have,

$$u_x = u_0 + x\delta u_{\frac{1}{2}} + \frac{x(x-1)}{\underline{|2}}\mu B_{\frac{1}{2}} + \frac{x(x-1)(x-\frac{1}{2})}{\underline{|3}} C_{\frac{1}{2}}. \qquad (56)$$

This may be taken as a general expression for a function of the third degree having u_0 and u_1 as particular values. This expression contains two constants which are as yet undetermined. It may consequently be made to satisfy two further conditions.

The expression for the first differential coefficient of this function is

$$\frac{du_x}{dx} = \delta u_{\frac{1}{2}} + (x - \tfrac{1}{2})\mu B_{\frac{1}{2}} + \frac{3x^2 - 3x + \frac{1}{2}}{6} C_{\frac{1}{2}}. \tag{57}$$

Hence,

$$\frac{du_0}{dx} = \delta u_{\frac{1}{2}} - \tfrac{1}{2}\mu B_{\frac{1}{2}} + {}_1{}^1{}_2 C_{\frac{1}{2}}, \tag{58}$$

$$\frac{du_1}{dx} = \delta u_{\frac{1}{2}} + \tfrac{1}{2}\mu B_{\frac{1}{2}} + {}^1{}_{1\,2} C_{\frac{1}{2}}. \tag{59}$$

If, then, we equate these expressions for du_0/dx and du_1/dx to those given in equations (40) and (42), neglecting third differences in those equations, we have,

$$\delta u_{\frac{1}{2}} - \tfrac{1}{2}\mu B_{\frac{1}{2}} + {}^1{}_{1\,2} C_{\frac{1}{2}} = \mu\delta u_0 = \delta u_{\frac{1}{2}} - \tfrac{1}{2}\delta^2 u_0,$$
$$\delta u_{\frac{1}{2}} + \tfrac{1}{2}\mu B_{\frac{1}{2}} + {}^1{}_{1\,2} C_{\frac{1}{2}} = \mu\delta u_1 = \delta u_{\frac{1}{2}} + \tfrac{1}{2}\delta^2 u_1.$$

Hence,

$$\mu B_{\frac{1}{2}} = \mu\delta^2 u_{\frac{1}{2}}$$
$$\tfrac{1}{6} C_{\frac{1}{2}} = \tfrac{1}{2}\delta^3 u_{\frac{1}{2}} \text{ or } C_{\frac{1}{2}} = 3\delta^3 u_{\frac{1}{2}}.$$

Therefore,

$$u_x = u_0 + x\delta u_1 + \frac{x(x-1)}{2}\mu\delta^2 u_{\frac{1}{2}} + \frac{x(x-1)(x-\frac{1}{2})}{2}\delta^3 u_{\frac{1}{2}} \tag{60}$$

$$= u_0 + x(u_1 - u_0) + \frac{x(x-1)}{4}(\delta^2 u_0 + \delta^2 u_1)$$
$$+ \frac{x(x-1)(x-\frac{1}{2})}{2}(\delta^2 u_1 - \delta^2 u_0)$$
$$= xu_1 + \frac{x^2(x-1)}{2}\delta^2 u_1 + yu_0 + \frac{y^2(y-1)}{2}\delta^2 u_0. \tag{61}$$

This is Karup's formula and equation (61) puts it into Everett's type of formula for practical application. It might also have been derived by equating $u_{\frac{1}{2}}$ to the value given by the Newton-Bessel formula to third differences and determining $\mu B_{\frac{1}{2}}$ and $C_{\frac{1}{2}}$ from this equation and the further condition that $\frac{du_x}{dx}$ should be continuous at the points of function. The first equation is

$$u_0 + \tfrac{1}{2}\delta u_{\frac{1}{2}} - \tfrac{1}{8}\mu B_{\frac{1}{2}} = u_0 + \tfrac{1}{2}\delta u_{\frac{1}{2}} - \tfrac{1}{8}\mu\delta^2 u_{\frac{1}{2}} \text{ or } \mu B_{\frac{1}{2}} = \mu\delta^2 u_{\frac{1}{2}}.$$

Equating then the values of $\frac{du_0}{dx}$ derived from equation (58)

and from (59) with subscripts reduced by unity, we have,

$$\delta u_{\frac{1}{2}} - \tfrac{1}{2}\mu\delta^2 u_{\frac{1}{2}} + \tfrac{1}{12}C_{\frac{1}{2}} = \delta u_{-\frac{1}{2}} + \tfrac{1}{2}\mu\delta^2 u_{-\frac{1}{2}} + \tfrac{1}{12}C_{-\frac{1}{2}}$$

or

$$\delta^2 u_0 - \mu^2\delta^2 u_0 + \tfrac{1}{12}\delta C_0 = 0$$
$$\delta^2 u_0 - (\delta^2 u_0 + \tfrac{1}{4}\delta^4 u_0) + \tfrac{1}{12}\delta C_0 = 0$$
$$\tfrac{1}{12}\delta C_0 = \tfrac{1}{4}\delta^4 u_0$$
$$C_{\frac{1}{2}} = 3\delta^3 u_{\frac{1}{2}} + k$$

where k is an arbitrary constant, Karup's formula being obtained by putting zero for k.

Henderson's Formula.

Suppose now that with the same assumption as before as to the general form of the function of the third degree we determine $\mu B_{\frac{1}{2}}$ and $C_{\frac{1}{2}}$ from the conditions that the values of the first and second differential coefficients should be continuous at the points of junction, if differences of the sixth and higher orders vanish. We have, then, for the second differential coefficient,

$$\frac{d^2 u_x}{dx^2} = \mu B_{\frac{1}{2}} + (x - \tfrac{1}{2})C_{\frac{1}{2}}, \tag{62}$$

whence

$$\frac{d^2 u_0}{dx^2} = \mu B_{\frac{1}{2}} - \tfrac{1}{2}C_{\frac{1}{2}}, \tag{63}$$

$$\frac{d^2 u_1}{dx^2} = \mu B_{\frac{1}{2}} + \tfrac{1}{2}C_{\frac{1}{2}}, \tag{64}$$

or reducing subscripts in (64) by unity

$$\frac{d^2 u_0}{dx^2} = \mu B_{-\frac{1}{2}} + \tfrac{1}{2}C_{-\frac{1}{2}}. \tag{65}$$

Equating these two expressions for d^2u_0/dx^2, we have,

$$\mu\delta B_0 = \mu C_0. \tag{66}$$

This is satisfied if $C_x = \delta B_x$ for all values of x so that

$$C_{\frac{1}{2}} = \delta B_{\frac{1}{2}}. \tag{67}$$

The difference between the two values of du_0/dx derived from equation (58) and from (59) with subscripts reduced by unity is

$$\begin{aligned}\delta^2 u_0 - \mu^2 B_0 + \tfrac{1}{12}\delta C_0 &= \delta^2 u_0 - (B_0 + \tfrac{1}{4}\delta^2 B_0) + \tfrac{1}{12}\delta^2 B_0 \\ &= \delta^2 u_0 - B_0 - \tfrac{1}{6}\delta^2 B_0. \end{aligned} \tag{68}$$

The values will accordingly be continuous if

$$B_0 + \tfrac{1}{6}\delta^2 B_0 = \delta^2 u_0.$$

This equation may be stated symbolically

$$(1 + \tfrac{1}{6}\delta^2)B_0 = \delta^2 u_0$$

or

$$\begin{aligned} B_0 &= \delta^2(1 + \tfrac{1}{6}\delta^2)^{-1}u_0 \\ &= (\delta^2 - \tfrac{1}{6}\delta^4 + \tfrac{1}{36}\delta^6 - \text{etc.})u_0 \\ &= \delta^2 u_0 - \tfrac{1}{6}\delta^4 u_0 \end{aligned} \tag{69}$$

if we neglect sixth and higher differences. We may check this result by noting that $\delta^2 B_0 = \delta^4 u_0$, to fifth differences, so that,

$$B_0 + \tfrac{1}{6}\delta^2 B_0 = \delta^2 u_0.$$

Then, since

$$C_{\frac{1}{2}} = \delta B_{\frac{1}{2}} = \delta^3 u_{\frac{1}{2}} - \tfrac{1}{6}\delta^5 u_{\frac{1}{2}}$$

we have,

$$\begin{aligned} u_x &= u_0 + x\delta u_{\frac{1}{2}} + \frac{x(x-1)}{\underline{|2}}(\mu\delta^2 u_{\frac{1}{2}} - \tfrac{1}{6}\mu\delta^4 u_{\frac{1}{2}}) \\ &\quad + \frac{x(x-1)(x-\frac{1}{2})}{\underline{|3}}(\delta^3 u_{\frac{1}{2}} - \tfrac{1}{6}\delta^5 u_{\frac{1}{2}}) \qquad (70) \\ &= u_0 + x(u_1 - u_0) + \frac{x(x-1)}{4}\{(\delta^2 u_0 - \tfrac{1}{6}\delta^4 u_0) + (\delta^2 u_1 - \tfrac{1}{6}\delta^4 u_1)\} \\ &\quad + \frac{x(x-1)(x-\frac{1}{2})}{6}\{(\delta^2 u_1 - \tfrac{1}{6}\delta^4 u_1) - (\delta^2 u_0 - \tfrac{1}{6}\delta^4 u_0)\} \\ &= xu_1 + \frac{x(x^2-1)}{6}(\delta^2 u_1 - \tfrac{1}{6}\delta^4 u_1) \\ &\quad + yu_0 + \frac{y(y^2-1)}{6}(\delta^2 u_0 - \tfrac{1}{6}\delta^4 u_0). \qquad (71) \end{aligned}$$

It will be seen that this formula in Everett's form as given in equation (71) is the same as the Newton-Bessel formula except that the fourth differences are applied as a correction to the second instead of being either taken into account separately or neglected. The discontinuity in the first differential coefficient amounting to $\frac{1}{36}\delta^6 u_0$ is somewhat less than that of $\frac{1}{30}\delta^6 u_0$ in the Newton-Bessel formula carried to fifth differences.

Sprague's Formula.

The two preceding formulas have been taken up before Sprague's because of their simpler character although his was

the first in point of time. The others may be considered as applications to a partial extent of the principles involved in Sprague's formula and they were, in fact, suggested by it. In Sprague's formula a series of the fifth degree is used and there are consequently two additional constants so that it can be made to satisfy four condiions besides reproducing the values u_0 and u_1 of the function.

The four conditions imposed are that the first and second differential coefficients at the points of junction should be the same as in the Newton-Stirling formula to fourth differences.

The general equation may be written:

$$u_x = u_0 + x\delta u_{\frac{1}{2}} + \frac{x(x-1)}{2}\mu B_{\frac{1}{2}} + \frac{x(x-1)(x-\frac{1}{2})}{6}C_{\frac{1}{2}}$$
$$+ \frac{x(x^2-1)(x-2)}{24}\mu D_{\frac{1}{2}} + \frac{x(x^2-1)(x-2)(x-\frac{1}{2})}{120}E_{\frac{1}{2}}. \quad (72)$$

Hence,

$$\frac{du_x}{dx} = \delta u_{\frac{1}{2}} + (x-\tfrac{1}{2})\mu B_{\frac{1}{2}} + \left(\frac{x^2}{2} - \frac{x}{2} + \frac{1}{12}\right)C_{\frac{1}{2}}$$
$$+ \left(\frac{x^3}{6} - \frac{x^2}{4} - \frac{x}{12} + \frac{1}{12}\right)\mu D_{\frac{1}{2}} + \left(\frac{x^4}{24} - \frac{x^3}{12} + \frac{x}{24} - \frac{1}{120}\right)E_{\frac{1}{2}}$$
$$\frac{d^2u_x}{dx^2} = \mu B_{\frac{1}{2}} + (x-\tfrac{1}{2})C_{\frac{1}{2}} + \left(\frac{x^2}{2} - \frac{x}{2} - \frac{1}{12}\right)\mu D_{\frac{1}{2}}$$
$$+ \left(\frac{x^3}{6} - \frac{x^2}{4} + \frac{1}{24}\right)E_{\frac{1}{2}}$$

Equating the values of du_0/dx, du_1/dx, d^2u_0/dx^2 and d^2u_1/dx^2 from these equations to those from equations (40) to (43) inclusive we have,

$$\delta u_{\frac{1}{2}} - \tfrac{1}{2}\mu B_{\frac{1}{2}} + \tfrac{1}{12}C_{\frac{1}{2}} + \tfrac{1}{12}\mu D_{\frac{1}{2}} - \tfrac{1}{120}E_{\frac{1}{2}} = \mu\delta u_0 - \tfrac{1}{6}\mu\delta^3 u_0$$
$$= \delta u_{\frac{1}{2}} - \tfrac{1}{2}\delta^2 u_0 - \tfrac{1}{6}\delta^3 u_{\frac{1}{2}} + \tfrac{1}{12}\delta^4 u_0$$
$$= \delta u_{\frac{1}{2}} - \tfrac{1}{2}\mu\delta^2 u_{\frac{1}{2}} + \tfrac{1}{12}\delta^3 u_{\frac{1}{2}} + \tfrac{1}{12}\mu\delta^4 u_{\frac{1}{2}} - \tfrac{1}{24}\delta^5 u_{\frac{1}{2}},$$
$$\delta u_{\frac{1}{2}} + \tfrac{1}{2}\mu B_{\frac{1}{2}} + \tfrac{1}{12}C_{\frac{1}{2}} - \tfrac{1}{12}\mu D_{\frac{1}{2}} - \tfrac{1}{120}E_{\frac{1}{2}} = \mu\delta u_1 - \tfrac{1}{6}\mu\delta^3 u_1$$
$$= \delta u_{\frac{1}{2}} + \tfrac{1}{2}\delta^2 u_1 - \tfrac{1}{6}\delta^3 u_{\frac{1}{2}} - \tfrac{1}{12}\delta^4 u_1$$
$$= \delta u_{\frac{1}{2}} + \tfrac{1}{2}\mu\delta^2 u_{\frac{1}{2}} + \tfrac{1}{12}\delta^3 u_{\frac{1}{2}} - \tfrac{1}{12}\mu\delta^4 u_{\frac{1}{2}} - \tfrac{1}{24}\delta^5 u_{\frac{1}{2}},$$
$$\mu B_{\frac{1}{2}} - \tfrac{1}{2}C_{\frac{1}{2}} - \tfrac{1}{12}\mu D_{\frac{1}{2}} + \tfrac{1}{24}E_{\frac{1}{2}} = \delta^2 u_0 - \tfrac{1}{12}\delta^4 u_0$$
$$= \mu\delta^2 u_{\frac{1}{2}} - \tfrac{1}{2}\delta^3 u_{\frac{1}{2}} - \tfrac{1}{12}\mu\delta^4 u_{\frac{1}{2}} + \tfrac{1}{24}\delta^5 u_{\frac{1}{2}},$$
$$\mu B_{\frac{1}{2}} + \tfrac{1}{2}C_{\frac{1}{2}} - \tfrac{1}{12}\mu D_{\frac{1}{2}} - \tfrac{1}{24}E_{\frac{1}{2}} = \delta^2 u_1 - \tfrac{1}{12}\delta^4 u_1$$
$$= \mu\delta^2 u_{\frac{1}{2}} + \tfrac{1}{2}\delta^3 u_{\frac{1}{2}} - \tfrac{1}{12}\mu\delta^4 u_{\frac{1}{2}} - \tfrac{1}{24}\delta^5 u_{\frac{1}{2}}.$$

Hence,

$$\begin{aligned}
\mu B_{\frac{1}{2}} - \tfrac{1}{6}\mu D_{\frac{1}{2}} &= \mu\delta^2 u_{\frac{1}{2}} - \tfrac{1}{6}\mu\delta^4 u_{\frac{1}{2}},\\
C_{\frac{1}{2}} - \tfrac{1}{10}E_{\frac{1}{2}} &= \delta^3 u_{\frac{1}{2}} - \tfrac{1}{2}\delta^5 u_{\frac{1}{2}},\\
\mu B_{\frac{1}{2}} - \tfrac{1}{12}\mu D_{\frac{1}{2}} &= \mu\delta^2 u_{\frac{1}{2}} - \tfrac{1}{12}\mu\delta^4 u_{\frac{1}{2}},\\
C_{\frac{1}{2}} - \tfrac{1}{12}E_{\frac{1}{2}} &= \delta^3 u_{\frac{1}{2}} - \tfrac{1}{12}\delta^5 u_{\frac{1}{2}},
\end{aligned}$$

and therefore,

$$\begin{aligned}
\mu B_{\frac{1}{2}} &= \mu\delta^2 u_{\frac{1}{2}},\\
\mu D_{\frac{1}{2}} &= \mu\delta^4 u_{\frac{1}{2}},\\
C_{\frac{1}{2}} &= \delta^3 u_{\frac{1}{2}} + 2\delta^5 u_{\frac{1}{2}},\\
E_{\frac{1}{2}} &= 25\delta^5 u_{\frac{1}{2}},
\end{aligned}$$

whence,

$$\begin{aligned}
u_x &= u_0 + x\delta u_{\frac{1}{2}} + \frac{x(x-1)}{\lfloor 2}\mu\delta^2 u_{\frac{1}{2}} + \frac{x(x-1)(x-\frac{1}{2})}{\lfloor 3}(\delta^3 u_{\frac{1}{2}} + 2\delta^5 u_{\frac{1}{2}})\\
&\quad + \frac{x(x^2-1)(x-2)}{\lfloor 4}\mu\delta^4 u_{\frac{1}{2}} + 25\,\frac{x(x^2-1)(x-2)(x-\frac{1}{2})}{\lfloor 3}\delta^5 u_{\frac{1}{2}}\\
&= u_0 + x\delta u_{\frac{1}{2}} + \frac{x(x-1)}{\lfloor 2}\mu\delta^2 u_{\frac{1}{2}} + \frac{x(x-1)(x-\frac{1}{2})}{\lfloor 3}\delta^3 u_{\frac{1}{2}}\\
&\quad + \frac{x(x^2-1)(x-2)}{\lfloor 4}\mu\delta^4 u_{\frac{1}{2}} + \frac{x(x-1)(x-\frac{1}{2})(5x^2-5x-2)}{\lfloor 4}\delta^5 u_{\frac{1}{2}} \qquad (73)\\
&= u_0 + x(u_1 - u_0) + \frac{x(x-1)}{4}(\delta^2 u_0 + \delta^2 u_1)\\
&\quad + \frac{x(x-1)(x-\frac{1}{2})}{6}(\delta^2 u_1 - \delta^2 u_0) + \frac{x(x^2-1)(x-2)}{48}(\delta^4 u_0 + \delta^4 u_1)\\
&\quad + \frac{x(x-1)(x-\frac{1}{2})(5x^2-5x-2)}{24}(\delta^4 u_1 - \delta^4 u_0)\\
&= xu_1 + \frac{x(x^2-1)}{6}\delta^2 u_1 + \frac{x^3(x-1)(5x-7)}{24}\delta^4 u_1\\
&\quad + yu_0 + \frac{y(y^2-1)}{6}\delta^2 u_0 + \frac{y^3(y-1)(5y-7)}{24}\delta^4 u_0. \qquad (74)
\end{aligned}$$

It will be noted that the coefficients of $\frac{\delta^2 u_1}{5^2}$ are the same as for the Newton-Bessel formula while the coefficients of $\frac{\delta^4 u_1}{5^4}$ are as follows:

x	Coefficient of $\frac{\delta^4 u_1}{5^4}$
$\frac{1}{5}$	1
$\frac{2}{5}$	5
$\frac{3}{5}$	9
$\frac{4}{5}$	8

These coefficients are much simpler than those in the Newton-Bessel formula.

The following table shows the application of Sprague's formula to the numerical example already cited:

$n+x$	xu_{n+1}	$\frac{x(x^2-1)}{6}\delta^3 u_{n+1}$	$\frac{x^3(x-1)(5x-7)}{24}\delta^4 u_{n+1}$	$\varphi(n:x)$	$\varphi(\overline{n-1}:\overline{1-x})$	u_{n+x}
$-\frac{4}{5}$	1036.8	− 115.2	+ 4	925.6		
$-\frac{3}{5}$	2073.6	− 201.6	+ 20	1892.0		
$-\frac{2}{5}$	3110.4	− 230.4	+ 36	2916.0		
$-\frac{1}{5}$	4147.2	− 172.8	+ 32	4006.4		
0	5184.	(144)	(4)			5184
$\frac{1}{5}$	2332.8	− 259.2	+ 9	2082.6	4006.4	6089
$\frac{2}{5}$	4665.6	− 453.6	+ 45	4257.0	2916.0	7173
$\frac{3}{5}$	6998.4	− 518.4	+ 81	6561.0	1892.0	8453
$\frac{4}{5}$	9331.2	− 388.8	+ 72	9014.4	925.6	9940
1	11664.	(324)	(9)			11664

Examples.

It will be a useful exercise for the student to derive formulas of various degrees to satisfy different conditions. The following examples are given with indications of the resulting values of the constants.

Second Difference Formula.

(1) The value of $\frac{du_x}{dx}$ to be continuous at the points of junction to fifth differences, i.e., if sixth and higher differences vanish.

$$B_x = \delta^2 u_x - \tfrac{1}{4}\delta^4 u_x.$$

Third Difference Formulas.

(2) The value of $u_{\frac{1}{2}}$ to be the same as in the Newton-Bessel formula to fourth differences and the values of $\frac{du_x}{dx}$ to be continuous to fifth differences.

$$B_x = \delta^2 u_x - \tfrac{3}{16}\delta^4 u_x; \qquad C_x = \tfrac{3}{4}\delta^3 u_x - \tfrac{9}{16}\delta^5 u_x.$$

(3) The values of $\frac{du_x}{dx}$ at the points of junction to be the same as in the Newton-Stirling formula to third differences.

$$B_x = \delta^2 u_x - \tfrac{1}{6}\delta^4 u_x; \qquad C_x = \delta^3 u_x - \tfrac{1}{2}\delta^5 u_x.$$

Fourth Difference Formulas.

(4) The value of $u_{\frac{1}{2}}$ to be the same as in the Newton-Bessel formula to fourth differences and the values of $\frac{du_x}{dx}$ at the points of junction to be the same as in the Newton-Stirling formula to fourth differences.

$$B_x = \delta^2 u_x; \qquad C_x = \delta^3 u_x - \tfrac{1}{2}\delta^5 u_x; \qquad D_x = \delta^4 u_x.$$

(5) The value of $u_{\frac{1}{2}}$ to be the same as in the Newton-Bessel formula to fourth differences and the values of $\frac{du_x}{dx}$ and $\frac{d^2u_x}{dx^2}$ to be continuous at the points of junction.

$$B_x = \delta^2 u_x - \tfrac{5}{6}\delta^4 u_x; \qquad C_x = \delta^3 u_x - \tfrac{1}{2}\delta^5 u_x; \qquad D_x = -4\delta^4 u_x.$$

Fifth Difference Formulas.

(6) The values of $u_{\frac{1}{2}}$ and $\frac{du_{\frac{1}{2}}}{dx}$ to be the same as in the Newton-Bessel formula to fourth differences and the values of $\frac{du_x}{dx}$ at the points of junction to be the same as in the Newton-Stirling formula to fourth differences.

$$B_x = \delta^2 u_x; \quad C_x = \delta^3 u_x - 4.5\delta^5 u_x; \quad D_x = \delta^4 u_x; \quad E_x = -40\delta^5 u_x.$$

(7) The values of $\frac{du_x}{dx}$ to be continuous at the points of junction and $B_x = \delta^2 u_x$; $C_x = \delta^3 u_x$ and $D_x = \delta^4 u_x$.

$$E_x = 5\delta^5 u_x.$$

Actuarial Note.

An Approximate Method of Calculating the Monthly Expected Cost of Insurance.

BY

PERCY C. H. PAPPS.

Starting on page 311 of Volume VII of the *Transactions* will be found the paper by Mr. Arthur Hunter dealing with an approximate method of calculating the expected mortality. Mr. Hunter shows on the first page of his paper that the ratio of expected mortality to the mean insurance in force is not a constant and does not increase or decrease proportionately with changes in the amount of mean insurance in force. Doubtless the ratio in question which Mr. Hunter calls the rate of mortality per thousand is affected in any calendar year by the distribution of the new business by ages, but it is affected probably more by the rate of persistency or non-persistency prevailing amongst older lives. For example, where the mortality amongst old persons has been heavy, the expected rate of mortality per thousand in the following year would likely show quite a marked decrease.

While any method of approximation based upon the rate of mortality per thousand may be too inaccurate as a means of ascertaining the expected cost of insurance for the Gain and Loss Exhibit, the error involved may not be sufficiently great to condemn the method as a means of estimating the ratio of actual to expected mortality month by month throughout the year. The object of this Note is to set forth a rather simple method of computing the expected cost of insurance for each month of the year, so that by keeping track of the actual cost of insurance it is possible to ascertain the ratio of actual to expected for each month. It is also valuable to compute the ratio of actual to expected for the first two months, the first three months, et cetera, throughout the year.

The suggested method may perhaps be best explained by showing the computations of the monthly expected cost of insurance. A

copy of these computations is shown at the end of this Note. In the first column is entered the month. In the second column is entered one twenty-fourth of the insurance in force at the end of the month. For the year 1920 one twenty-fourth of the insurance in force is shown for December 31, 1919, as well as for the end of each month of 1920 from January to December. In the third column is entered the summation of the items in the second column taken in pairs. This third column, therefore, represents one-twelfth of the mean amount of insurance in force in each month. In any plan of estimating the cost of insurance by months it is well to allow for the different number of days in each month. There being three hundred and sixty-six days in the year 1920, the figures in the third column are multiplied by thirty-one times twelve divided by three hundred and sixty-six for months having thirty-one days; thirty times twelve divided by three hundred and sixty-six for months with thirty days and twenty-nine times twelve divided by three hundred and sixty-six for February. These weighted figures are entered in the fourth column.

If the problem is to divide up the cost of insurance by months when the cost for the entire year has been computed, then, the expected cost being known, the total of the items in column four may be divided into the expected cost and the result will be the expected cost of insurance per thousand dollars of mean insurance in force. A multiplication of the figures given in column four by the expected cost per thousand will give the expected cost for each month in 1920 and these figures are entered in column five. If it is desired to build up the expected cost by months throughout the year, then the expected cost per thousand must be estimated from the similar figures of previous years. Having ascertained the expected cost of insurance for each month, a summation of these figures from the top down will give the expected cost for the first two months, the first three months, et cetera.

If the actual cost of insurance is ascertained each month throughout the year, it may happen that the total of the twelve monthly items may not equal the actual cost of insurance as shown in the Gain and Loss Exhibit. For instance, claims for death losses reported, for which proofs have not been received, may be an estimated amount and, if the estimate is different at the end of the year from what it was at the end of the previous year, the claims incurred as

shown in the Gain and Loss Exhibit will be affected thereby. Any difference of this character may be readily adjusted by spreading the small difference over each month of the year.

If the expected cost of insurance for the year is estimated month by month throughout the year, the accuracy of the estimate will, of course, depend upon whether or not the expected cost of insurance per thousand differs much from the estimate. During the three years, 1918, 1919 and 1920, the expected cost of insurance per thousand of mean insurance in force in The Mutual Benefit Life Insurance Company was as follows: 1918, 10.294355; 1919, 10.336455, and 1920, 10.238774. It will be noticed that the increase in the large new business of 1919 as compared with that of 1918 was accompanied by an increase in the expected cost of insurance per thousand. The new business of 1920 was a still larger percentage of insurance in force than was that of 1919. Yet the cost of insurance per thousand is less than it was in 1918, let alone 1919. It is possible that the increase in the expected cost per thousand in 1919 over that of 1918 was due to the persistency of the business on old lives. The decrease in 1920 may possibly be accounted for by the fact that the very large new businesses of 1919 and 1920 together have overweighed the effect of older lives. Nevertheless, had an average value of $10.30 per thousand been taken for the expected cost of insurance in 1920, which is fairly consistent with the values of 1918 and 1919, the error introduced would not have been sufficiently great to have destroyed the value of the preliminary figures made up on a monthly basis. The greatest error, of course, would be in the figures for twelve months. Had an average figure of $10.30 been used in each of the last three years, the error would have been as follows:

Year.	Expected Cost of Insurance.			Ratio of Actual Cost to Expected.		
	Computed.	At $10.30 per $1,000.	Diff.	Computed.	At $10.30 per $1,000.	Diff.
1918	$ 9,820,994	$ 9,826,378	+$5,384	86.67%	86.62%	−.05%
1919	10,996,109	10,957,326	−38,783	60.66	60.88	+.22
1920	12,693,234	12,769,137	+75,903	52.24	51.92	−.32

The computations at the close of the year 1920 are:

	1/24 Insurance in Force.	Totals in Pairs.	Weighted for Days in Months.
Dec. 31st, 1919.....	$47,618,630		
Jan. (31) 1920.....	48,282,734	$ 95,901,364	$ 97,473,513
Feb. (29) "	49,082,234	97,364,968	92,576,527
Mar. (31) "	49,852,150	98,934,384	100,556,255
Apr. (30) "	50,526,281	100,378,431	98,732,883
May (31) "	51,313,974	101,840,255	103,509,763
June (30) "	52,025,174	103,339,148	101,645,064
July (31) "	52,497,317	104,522,491	106,235,970
Aug. (31) "	52,997,228	105,494,545	107,223,959
Sep. (30) "	53,448,881	106,446,109	104,701,090
Oct. (31) "	54,002,405	107,451,286	109,212,778
Nov. (30) "	54,441,323	108,443,728	106,665,962
Dec. (31) "	54,953,561	109,394,884	111,188,238
Total.....		$1,239,511,593	$1,239,722,002
		Expected Cost from gain and loss exhibit.	12,693,234
		Expected cost per thousand	$10,238,774

	Weighted Figures × 10.238774 per 1000.	Expected Cost to End of Month.
Jan. (31) 1920	$998,009	$998,009
Feb. (29) "	947,870	1,945,879
Mar. (31) "	1,029,573	2,975,452
Apr. (30) "	1,010,904	3,986,356
May (31) "	1,059,813	5,046,169
June (30) "	1,040,721	6,086,890
July (31) "	1,087,726	7,174,616
Aug. (31) "	1,097,842	8,272,458
Sep. (30) "	1,072,011	9,344,469
Oct. (31) "	1,118,205	10,462,674
Nov. (30) "	1,092,129	11,554,803
Dec. (31) "	1,138,431	12,693,234
Total	$12,693,234	

Causes of Total and Permanent Disability.

BY

JOHN S. THOMPSON.

In July, 1857, in a letter regarding A. G. Finlaison's "Tables for Allowances in Sickness," Mr. John A. Higham stated: "Insurance companies will confer another boon on men who, in common with their families, depend on their professional exertions, when, on sufficient data, they can afford the means of providing against permanent sickness—the only ill, legitimately within their province, against which they do not afford protection." (*Assurance Magazine,* Vol. VII, 115.) After a lapse of about half a century, this proposal was taken up in this country and in recent years has been very fully developed with regard to standard lives. It remains, therefore, to consider the possibility of extending these benefits to certain under-standard lives,—a phase of insurance against total and permanent disability which as yet has received little attention.

Experience under Total and Permanent Disability Benefits is still too limited, even if that of all life companies doing this business were to be combined, to lead to any reliable conclusions except that the Hunter Disability Table is a conservative basis for premiums and reserves. An attempt was recently made, however, in the light of such deductions as might be made from the very narrow disability experience of the Mutual Life, as will be hereinafter explained, to construct some tables which might be helpful in dealing with certain types of risks which could not be accepted for total and permanent disability benefits at standard rates of premium. This presupposes knowledge as to (1) rate of disability by causes, and (2) rate of mortality after disability in the groups arising from those causes. Such detailed subdivision is, of course, impossible. But the problem was attacked from the point of view of modification of these elements—r_x and q^i_x—of the standard table; the Hunter q^i_x has been adopted as a satisfactory estimate of the rate of mortality after disability and it was thought that it might be pos-

sible to modify this assumed rate as indicated by the experience in certain significant groups. The limited nature of the experience and the fact that the business is all recently issued prevent the results from having any general value, but a line of analysis will be indicated which may have a more practical application at a later date. In any case, details of an additional disability experience may perhaps be of interest.

The disability experience to which attention is here drawn dates from January 1, 1913, for this was the date when the issuance of policies with the Waiver of Premium Benefit was commenced. The more comprehensive benefit, including an income upon disability (not reducing the face of the policy) was introduced in 1917; no change was then made in the principles of selection as applied to these risks, but the limits of amounts under the new clause were suitably modified. In case of each claim included in the table given below, the life survived to the anniversary following the occurrence of disability and the approval of the claim involved the waiver of the premium then due; no benefits were payable during the year of disability.

Up to December 31, 1920, claims had been approved under 242 contracts, involving 202 lives, distributed as to cause of disability as follows, other columns being added for comparison:

Cause of Disability.	Percentage Distribution (Lives).			
	Mutual (1913–1919, inclusive).	Co. "A."*	Co. "B."*	Co. "C."*
Tuberculosis	38%	45%	31%	30%
Insanity	28	23	23	31
Paralysis	10	6	14	7
Accident	4	4	3	4
Cancer	3	4	2	4
Heart disease	3	3	1	2
Blindness	2	2	5	1
Rheumatism	5	2	2	–
Other causes	7	11	19	21

In the paper from which the comparisons are drawn, Mr. Hunter discusses fully the varying conditions as to the treatment of this benefit in Cos. "A," "B" and "C." So far as outward circumstances go, the Mutual's experience would be expected to resemble that of Co. "A" more closely than either of the others.

* See Arthur Hunter's paper, "Analysis of Disability Claims," *T. A. S. A.*, Vol. XIX, 220.

The history of the group by lives as to deaths and recoveries, irrespective of age, may be briefly set forth as follows:

Disability Year.	Died.	Recovered.
1	55	16
2	9	5
3	1	0
4	0	1
5	0	0
6	0	0

Rate of Disability.

It was inconvenient to compare the actual and expected claims for disability on the basis of the premiums waived and expected to be waived and of the income paid and expected to be paid. The ratio of actual to expected disability claims was, however, observed on the basis of amounts of insurance only, where the "expected" was calculated by applying Hunter's rate of disability to the mean amount of insurance at risk in the successive years and the results are as follows:

Calendar Year.	Mean Amount at Risk.	Disability Claims (by Amounts of Insurance).		Ratio Per Cent. Actual to Expected.
		Expected.	Actual.	
1915.....	$114,281,000	$ 88,900	$ 11,000	12%
1916.....	169,129,000	134,600	31,000	23
1917.....	234,664,000	191,200	43,000	23
1918.....	309,848,000	262,300	94,000	36
1919.....	441,547,000	383,000	228,500	60
1920.....	638,189,000	557,100	175,000	31

The effect of selection is obvious; the low percentage for 1920 is undoubtedly due to the considerable number of cases unreported or in process of adjustment, since the above figures were made up in January, 1921. The 1919 ratio is perhaps worthy of further consideration (although the result may have been affected by sequelae of the 1918–1919 influenza epidemic) as the mean duration of the business is greater than at any earlier time. The 1919 experience by ages is, therefore, given as follows:

Attained Age.	Disability Claims (by Amounts of Insurance).		Ratio Per Cent. Actual to Expected.	Ratio Per Cent. Actual to Expected Excluding 1919 Issues.
	Expected.	Actual.		
Under 25.....	$ 51,900	$ 19,500	38%	48%
25–34.....	105,200	42,500	40	53
35–44.....	135,200	98,000	73	90
45 and over.....	90,700	68,500	76	94
Total.....	$383,000	$228,500	60%	75%

Thus the indication is that the Hunter Rate of Disability is favorable at the young ages in somewhat the same manner as is the American Experience Rate of Mortality.

The disability experience here shown compares favorably with that of the Metropolitan for 1917,—56 per cent. by number. and 55 per cent. by amounts (see Mr. Craig's discussion, *T. A. S. A.*, XX, 182)—and with that of the Prudential (see Mr. Little's discussion, XX, 188–189), all of which are at variance with the experience of Company "A" of Mr. Hunter's paper, XXI, 219. Whilst Mr. Little mentioned a very important influence in the possible selection against the company by the applicant who has to pay an extra premium for the disability benefit as compared with the policyholder who obtains the benefit for nothing, it is possible that the effect of selection by the insured may have been overrated or may with care be neutralized. On the other hand, it may prove to be more in evidence under the more expensive benefit.

Mortality by Causes of Disability.

It will be observed that 38 per cent. of the lives were disabled because of tuberculosis and 28 per cent. because of insanity, or almost two-thirds from these two causes alone. Furthermore, these causes are fairly well defined and are in all cases confirmed by careful investigation. This concentration upon a few causes does not occur in case of death claims under ordinary conditions; the deaths from tuberculosis amounted to about 10 per cent. of the total claims in the same company in the period 1907–1918, and the deaths from pneumonia and from all nervous diseases to about the same proportion respectively; even at ages under 30, the deaths from tuberculosis were well under 20 per cent. In view, therefore, of the importance of these two causes, their experiences were examined separately in order to determine whether a basis might be found for extra ratings in cases where it was possible to measure satisfactorily the additional chances of disablement from either or both of these causes in connection with a particular application.

The incidence of the various claims by ages at disability and the progression of each group by disability years is shown in the following tables. Hereafter, only lives (as distinguished from policies) will be referred to and it will be assumed in each case that "disablement" involves the survival of the life to the next succeeding anni-

versary. The fractional exposures are accounted for by the fact that the exposures were taken exactly to December 31, 1920, in each case.

Ages at Disability.	Number Disabled.	1st Disability Year.		2d Disability Year.		3d Disability Year.	
		Exposures.	Deaths.	Exposures.	Deaths.	Exposures.	Deaths.
Cause—Tuberculosis.							
Under 25.....	12	11.5	5	1.1	0	–	–
25–34.....	44	39.2	16	12.7	3	2.9	0
35–44.....	14	11.3	5	2.1	1	–	–
45 and over...	7	6.1	2	1.3	0	–	–
Total.....	77	68.1	28	17.2	4	2.9	0
Cause—Insanity.							
Under 25.....	8	8.0	0	5.8	0	2.0	0
25–34.....	15	14.0	4	5.8	1	2.3	0
35–44.....	21	18.9	4	9.2	3	4.8	1
45 and over...	12	10.4	4	2.5	0	1.2	0
Total.....	56	51.3	12	23.3	4	10.3	1
Causes—Miscellaneous.							
Under 25.....	6	5.5	0	1.5	0	–	–
25–34.....	19	16.3	3	7.0	0	3.7	0
35–44.....	13	12.5	4	5.3	0	0.8	0
45 and over...	31	25.3	8	7.2	1	2.0	0
Total.....	69	59.6	15	21.0	1	6.5	0
Total—All Causes.							
Under 25.....	26	25.0	5	8.4	0	2.0	0
25–34.....	78	69.5	23	25.5	4	8.9	0
35–44.....	48	42.7	13	16.6	4	5.6	1
45 and over...	50	41.8	14	11.0	1	3.2	0
Total.....	202	179.0	55	61.5	9	19.7	1

There are no deaths later than the third disability year which places a very immediate limit on the usefulness of the experience. This, of course, is due to the recency of the claims; the experience of the Travelers' to 1919 (see discussion of Mr. Morris, *T. A. S. A.*, XX, 190) was smaller, but having been built up since 1904 revealed some claims of greater persistency.

The ratio of actual to expected mortality according to Hunter's *Select* Mortality Table for Disabled Lives, is shown below for the first two disability years:

Age at Disability.	Expected.	Actual.	Ratio %.	Expected.	Actual.	Ratio %.
	Cause—Tuberculosis.			Cause—Insanity.		
First Year.						
Under 35....	19.2	21	110%	8.7	4	46%
35 and over..	5.2	7	135	8.6	8	93
Total.....	24.4	28	115%	17.3	12	69%
	Causes—Miscellaneous.			All Causes.		
Under 35....	8.4	3	36%	36.3	28	77%
35 and over..	10.7	12	112	24.5	27	110
Total.....	19.1	15	79%	60.8	55	90%
Second Year.						
	Cause—Tuberculosis.			Cause—Insanity.		
Under 35....	2.2	3	136%	2.2	1	45%
35 and over..	0.5	1	200	1.7	3	176
Total.....	2.7	4	148%	3.9	4	103%
	Causes—Miscellaneous.			All Causes.		
Under 35....	1.4	0	0%	5.9	4	68%
35 and over..	1.7	1	59	3.9	5	128
Total.....	3.1	1	32%	9.8	9	92%

It may also be worth while, in passing, to observe the rate of mortality as related to Hunter's aggregate of mortality (the tabular rate) on disabled lives, excluding the first disability year, since this was the course followed in establishing the aggregate table.

Attained Ages.	Expected Deaths.	Actual Deaths.	Ratio Per Cent.
Under 35.....	5.9	4	68%
35 and over.....	3.5	6	171
Total.....	9.4	10	106%

Thus the lives for whom disability benefits have been approved appear to conform fairly closely in the aggregate to the standard table (cf. Travelers' Experience above referred to, XX, 190).

The rates of mortality experienced in the *first* disability year in the various classes and for two age-groups are as follows:

Ages at Disability.	Expos.	Deaths.	Ratio.	Expos.	Deaths.	Ratio.
	Tuberculosis.			Insanity.		
Under 35....	50.7	21	.414	22.0	4	.182
35 and over..	17.4	7	.402	29.3	8	.273
Total.....	68.1	28	.411	51.3	12	.234
	Miscellaneous.			Total.		
Under 35....	21.8	3	.138	94.5	28	.296
35 and over..	37.8	12	.318	84.5	27	.320
Total.....	59.6	15	.251	179.0	55	.307

Analysis of Standard Disability Table.

The proportion of lives disabled in the three classes was observed to be:

Ages at Disability.	Tuberculosis.	Insanity.	Miscellaneous.	Average Age (All Groups).
Under 35.....	.54	.22	.24	27
35 and over.....	.21	.34	.45	44

from which, with due consideration to the distribution in the smaller and therefore more irregular age-groups, a corresponding table for each age was evolved. Specimen proportions are given below:

TABLE A.

Ages at Disability.	Tuberculosis.	Insanity.	Miscellaneous.
20.....	.55	.25	.20
30.....	.52	.25	.23
40.....	.39	.35	.26
50.....	.17	.35	.48

It was impossible to determine to what extent the distribution of the chance of disability among these three classes, at a given age, was dependent on the time the insurance had been in force.

The ratio of the actual first-year mortality in the three groups to the average first-year mortality for all groups was observed to be:

Ages at Disability.	Tuberculosis.	Insanity.	Miscellaneous.
Under 35.....	1.40	.61	.46
35 and over.....	1.26	.85	.99

from which, again with due regard to the experience in the smaller age-groups, a corresponding table for each age was constructed, specimen ratios being as follows:

TABLE B.

Ages at Disability.	Tuberculosis.	Insanity.	Miscellaneous.
20.....	1.35	.60	.55
30.....	1.32	.65	.72
40.....	1.28	.75	.87
50.....	1.25	.85	1.00
60.....	1.17	1.00	1.00
70.....	1.00	1.00	1.00

The ratios in Table A were applied to the standard r_x and those from Table B to the standard q_x^i, and with these assumed rates it was possible to construct a Combined Mortality and Disability Table in which each of the columns r_x, l_x^{ii} and d_x^{ii} was subdivided into three parts, thus, for example:

Age.	l_x^{aa}.	T_{r_x}.	$T_{l_x^{ii}}$.	$T_{d_x^{ii}}$.	I_{r_x}.	$I_{l_x^{ii}}$.	$I_{d_x^{ii}}$.	M_{r_x}.	$M_{l_x^{ii}}$.	$M_{d_x^{ii}}$.
20.....	92483	.000283	71	20	.000129	44	6	.000103	39	5
etc.										
50.....	69010	.000288	208	24	.000594	303	23	.000814	283	25

The calculation of a subdivided net premium may be carried out in the usual way. Sample results are given below, the premiums being for the following disability benefits on a policy for $1,000, (1) waiver of American 3 per cent. net premium, (2) income of 10 per cent. of face of policy beginning at end of year of disability and not reducing the policy; the total of the three elements is in each case, of course, the usual net premium for the benefit based on Hunter's Table:

Age at Entry.	Ordinary Life.				20-Payment Life.			
	T.	I.	M.	Total.	T.	I.	M.	Total.
25.....	$0.228	.332	.376	.936	$0.301	.415	.462	1.178
40.....	.240	.585	.782	1.607	.244	.562	.736	1.542
55.....	.103	1.255	2.220	3.577	.106	1.269	2.246	3.622

Age at Entry	20-Year Endowment.			
	T.	I.	M.	Total.
25.....	$0.199	.142	.113	.451
40.....	.222	.402	.470	1.094
55.....	.106	1.238	2.193	3.536

If because of certain circumstances an applicant is exposed to larger than normal chances of incurring one of the disabilities here referred to, and if such chance is reasonably measurable, an extra rating might be derived from an observation of the relation which the normal cost for such cause of disability bears to the total normal cost. But even if the subdivision of the normal rate were considered satisfactory such a course would be possible only within narrow limits of variation because of the resulting variation in $l_x''^{a}$ and other functions.

The foregoing analysis is one which could have been much more satisfactorily carried out with the help of the original data. The weakness of the results here deduced is, of course, that the business is recent and the experience small, as a corollary to which is the important circumstance that the first year (of disability) experience has been almost exclusively relied upon in making the desired subdivision. Moreover, the insanity group is not homogeneous and the third group is admittedly "all causes other than tuberculosis and insanity." It is for this reason that more detailed results are not submitted. At the same time it must be remembered that the standard Disabled Life Mortality bears little resemblance to the actual mortality on any class of disabled lives; it is not even an aggregate table, but is an aggregate table excluding the first disability year, the endeavor having been to make it conservative. It is believed that this conservatism has to some extent been distributed among the elements of the subdivided table. Furthermore, the results are consistent with this company's experience thus far and with its methods of selection of risks and of dealing with claims and may serve to throw some further light on the question of selection until more experience accumulates and results more worthy of confidence may be established.

Swedish Mortality Investigation.

Mortality Among Insured Lives Subject to Extra Hazard from Tuberculosis and from Certain Other Causes.

BY

JOSEPH B. MACLEAN.

The Society of Directors of Swedish Life Insurance Companies undertook in 1918 an investigation into the subject of the rates of extra mortality among insured lives subject to extra risk from certain impairments arising from defects in both personal and family history. The investigation was conducted by a committee headed by Mr. Sven Palme, which has now published the results.* These are of considerable interest, not only because of the extent of the observations and of the comparisons furnished with previous investigations (especially the Medico-Actuarial Investigation), but also because of the methods used in deriving the rates of extra mortality, methods which, so far as the writer is aware, are entirely novel and which appear to be, for practical reasons, worthy of careful examination.

I. Principles Used in the Investigation.

The customary method of measuring extra mortality among a group of lives sub-normal from any cause is to compare the actual deaths with those "expected" according to some standard. (See *inter alia,* M.-A. investigation and Kenchington and Rusher's Prudential investigation, J.I.A., XLVII.)

This method involves, of course, the tabulation of a mass of statistics relating to the living as well as to the dead. If statistics relating to the living could be eliminated, a great saving of labor would be effected. In the Swedish investigation the information supplied to the committee related entirely to deaths. The principles applicable to the treatment of such data and the extraction therefrom of comparative rates of mortality may be briefly ex-

* Undersökning av dödligheten bland tuberkulöst belastade och med vissa andra sjukdomsanlag behäftade försäkrade av Svenska lifförsäkringsbolags direktörsförenings för ändamålet utsedda kommittérade. Stockholm, 1921.

plained as follows. (These principles appear to be due to Dr. J. Pedersen.*)

The truth of the following "hypothesis" is assumed: *In a group of lives subject to extra risk from any impairment the mortality from causes which might be influenced by that impairment is greater than the mortality from these causes in a group of normal lives, while the mortality from other causes is the same in both groups.* Regarding this hypothesis, it will be enough to say that if statistics indicate its substantial truth this will be sufficient for practical purposes, bearing in mind the necessarily inexact nature of the subject. The Swedish actuaries satisfied themselves, by an examination of statistics relating to the causes of death, of the substantial validity of the hypothesis. It is to be noted further that the hypothesis implies the ability to separate the causes of death in any group into those which may have been influenced by the presence of a certain impairment and those which have not been so influenced. This, again, is a matter to be determined from statistics bearing on the causes of death and is largely a question of medical judgment.

Let l_x be a group of normal lives and λ_x a group of lives subject to a specified impairment, the two groups not necessarily having the same number of lives.

Let d_x be the total number of deaths per annum in the normal group and δ_x the number in the sub-normal group.

Let $d_x^{[i]}$ be the number out of the d_x deaths which were *not* due to a cause liable to be influenced by the impairment in question.

Let $\delta_x^{[i]}$ be the corresponding number out of the δ_x deaths.

Then, by the hypothesis,

$$\frac{\delta_x^{[i]}}{\lambda_x} = \frac{d^{[i]}}{l_x},$$

the rate of mortality from other causes than those referred to being the same in both groups.

Now, the total rate of mortality in the sub-normal group is δ_x/λ_x and in the normal group d_x/l_x, and the ratio of the former to the latter is $\delta_x/\lambda_x \div d_x/l_x$. But since

$$\frac{\delta_x^{[i]}}{\lambda_x} = \frac{d_x^{[i]}}{l_x}$$

* Ueber die Versicherung minderwertiger Leben. Jena, 1906.

this ratio is equal to

$$\frac{\delta_x}{\lambda_x} \cdot \frac{\lambda_x}{\delta_x^{[i]}} \div \frac{d_x}{l_x} \cdot \frac{l_x}{d_x^{[i]}}$$

$$i.e., \text{ to } \frac{\delta_x}{\delta_x^{[i]}} \cdot \frac{d_x^{[i]}}{d_x}$$

The last expression involves deaths alone and is the formula by which the total mortality ratios have been calculated for the impairment groups.

The object to be aimed at in the tabulation of the data is, therefore, to obtain the number of deaths in a normal group and the number of deaths in each sub-normal group, as well as the number of deaths in such groups from causes which are not liable to be influenced by the impairment under consideration. For example, the group of deaths among those subject to a tuberculosis impairment must be divided into those which were and those which were not the result of a cause influenced by the impairment, while the normal group must be split up in as many different ways as there are impairment groups.

As an illustration of the final results of such a process, tables are given below for two of the impairment groups, viz.:

(*i*) Brother or Sister has had Tuberculosis—T3;

(*ii*) Insured has had Albuminuria—N3.

(*i*) Impairment Group T3.

Age Group at Death.	Normal Group.		Impairment Group.*	
	d	$d^{[i]}$	δ	$\delta^{[i]}$
15–19	282	178	30	16
20–24	894	543	94	38
25–29	1,157	720	143	62
30–34	1,337	961	156	82
35–39	1,641	1,311	174	115
40–44	1,898	1,623	208	155
45–49	2,074	1,834	272	208
50–54	2,114	1,959	263	229
55–59	1,941	1,821	238	218
60–64	1,552	1,495	174	160
65–69	1,218	1,191	137	130
70–74	984	968	106	105
75–79	526	525	40	39
80–84	219	219	22	22
85–89	68	68	5	5
15–89	17,905	15,416	2,062	1,584

* Omitting decimals from adjusted values.

(*ii*) Impairment Group N3.

Age Group at Death.	Normal Group.		Impairment Group.*	
	d	$d^{[i]}$	δ	$\delta^{[i]}$
15–19.....	282	268	9	8
20–24.....	894	849	37	34
25–29.....	1,157	1,069	36	33
30–34.....	1,337	1,191	42	36
35–39.....	1,641	1,360	32	17
40–44.....	1,898	1,492	37	23
45–49.....	2,074	1,452	43	21
50–54.....	2,114	1,331	30	15
55–59.....	1,941	1,165	27	12
60–64.....	1,552	827	34	14
65–69.....	1,218	641	15	5
70–74.....	984	479	1	1
75–79.....	526	282	4	3
80–84.....	219	145	1	—
85–89.....	68	46	2	1
15–89.....	17,905	12,597	350	223

Details as to the method of determining the number of deaths comprised in the $d^{[i]}$ and $\delta^{[i]}$ columns are given in the following section.

II. Collection and Tabulation of the Data.

Sixteen companies contributed their experience to the investigation. The information was supplied on cards, a card being written for each death which occurred during the period of twenty-three years from 1895 to 1917, inclusive, with additional cards as stated below. Differently colored cards were used to distinguish males from females, but no use was made of the latter group on account of the smallness of the numbers (2,146 deaths).

Both sides of the card were used, the front being the same for all cases and the back being used for the special information relative to the particular impairment group to which the case belonged. If more than one impairment existed (2,879 cases), a separate card was written for each impairment, and this was noted on the front of the cards in the space for "Risk-class." Cards were written for all deaths, whether there was an impairment or not, in order to obtain the "normal" group for comparison.

There were six main impairment groups, each of which was subdivided. The group was denoted by a letter and the subdivision by a number, as follows:

* Omitting decimals from adjusted values.

T. *Tuberculosis.*

1. Father had tuberculosis.
2. Mother had tuberculosis.
3. Brothers or sisters had tuberculosis.
4. Insured has had pneumonia or other non-tuberculous pulmonary disease.
5. Insured has had inflammation of the pleura.
6. Insured has had tuberculosis.

V. *Heart Disease, etc.*

1. Parent has had heart disease.
2. Parent has had cerebral haemorrhage or arteriosclerosis.
3. Insured has had heart disease.
4. Insured has had articular rheumatism.

C. *Cancer, Ulcer of the Stomach, etc.*

1. Parent has had cancer.
2. Brother or sister has had cancer.
3. Insured has had a simple gastric ulcer or has vomited blood.
4. Insured has had some other serious gastric trouble.

D. *Diabetes.*

1. Parent has had diabetes.
2. Brother or sister has had diabetes.
3. Insured has had diabetes.

N. *Urinary Disease.*

1. Parent has had nephritis.
2. Brothers or sisters have had nephritis.
3. Insured has had albuminuria.
4. Insured has had blood, pus or gravel in the urine.

L. *Syphilis.*

1. Insured has had syphilis.
2. Insured has had a simple chancre.

The letter "A" was used to denote the normal group of deaths; *i.e.,* those occurring among lives not subject to any of the foregoing specified impairments.

The following specimens will indicate sufficiently the nature of the information called for on the cards.

FRONT OF CARD.

(All cards.)

Risk-Class.				Death-Class.
	Y.	M.	D.	
1. Date of entry	.....	.....	.....	.....
2. " " death	.....	.....	.....	.....
3. " " birth	.....	.....	.....	.....
4. Cause of Death				
5. Secondary Causes				
6.				
7. Restriction				
8. Cause				
9. Amount				
10.				
11. Occupation				
12. Number				
13. Company				

BACK OF CARD.

(T Group.)

T	Fath.	Moth.	Br. Sis.	Hs. Wf.	Ch.
1. Tuberculosis present . . .					
2. " suspected .					
3. " not present					
4. Spitting Blood?					
5. Pneumonia?					
6. Other Lung Affection?					
7. Pleurisy?					
8. Glands, etc., ?					
9.					
10. Sanitarium Treatment					
11.					
12.					
13. Constitution: Good; Ordinary; Poor					
14. Build? Thin; Normal; Fat; Corpt					
15. Measurements					
16. Chest					
17.					
18. Lungs					
19.					
20. Remarks					
21.					
22.					

The line for "Restriction" on the front of the cards refers to cases which were not issued on plan applied for or where an addition to the age was made or other form of extra rating applied. Such cases were apparently included in the investigation. Code letters were used for certain items in order to save time and space.

The total number of cards furnished is shown in the following table:

Group.	Males.	Females.
T	6,062	458
V	4,059	238
C	2,031	119
D	365	15
N	1,724	92
L	1,969	3
A	24,367	1,564
Total	40,577	2,489

After the cards had been completed and classified into risk groups they supplied the necessary data for tables of d and δ. In order to obtain separate tables of $d^{[i]}$ applicable to the ratios for each impairment group and of $\delta^{[i]}$, it was necessary to fix on the causes of death which were supposed to have been influenced by the specified impairments, so that the deaths resulting from such causes might be eliminated. The list of such causes was assumed to be as follows:

For impairment group T.

Tuberculosis.

For impairment group V.

Diseases of the nervous system except meningitis, cerebral abscess and spinal phthisis; diseases of the circulatory organs; nephritis.

For impairment group C.

Diseases of the digestive organs except liver diseases; tumors.

For impairment group D.

Diabetes; diseases of the nervous system as for group V.

For impairment group N.

Diseases of the nervous system as for group V; diseases of the circulatory organs; diseases of the urinary system.

For impairment group L.

Senile diseases; syphilis; diseases of the nervous system as for group V; mental diseases; diseases of the circulatory organs; liver diseases; nephritis.

By deducting deaths from the above causes from the total deaths, complete tables of d, $d^{[i]}$, δ and $\delta^{[i]}$ were obtained, and from these the ratios $d^{[i]} : d$ and $\delta : \delta^{[i]}$. These ratios were worked out for five-year groups of ages at death and for years of duration 0–4, 5–9, 10 and over, and 0 and over. The extra mortality ratio per cent. was then found from the expression—

$$100 \left\{ \frac{\delta}{\delta^{[i]}} \cdot \frac{d^{[i]}}{d} - 1 \right\}.$$

In determining the composition of $d^{[i]}$ and $\delta^{[i]}$ cases having more than one impairment were kept in view and specially treated.

III. Results of the Investigation.

The results of the investigation will be referred to under two heads, viz.:

(*a*) Causes of Death, and
(*b*) Rates of Extra Mortality.

(*a*) *Causes of Death.*—Since "numbers at risk" were not determined, causes of death are tabulated only in the form of percentage of each cause to the total from all causes. The only comparison which can be made with the Medico-Actuarial Investigation is that of standard lives (corresponding to group "A" in the Swedish investigation). The number of policies terminated by death is almost exactly equal in the two groups, being 17,792 in the former and 17,905 in the latter. As regards the Swedish table, it is noted that where secondary causes of death were recorded as well as primary, only the latter were tabulated for the "Causes of Death" tables.

Causes of Death.

TABLE A.

Cause of Death.	M.-A., Standard Male Lives.		Swedish Investigation. Impairment Group.													
			A		T		V		C		D		N		L	
	No.	% Tot.	No.	% Tot.	No.	% Tot.	No.	% Tot.	No.	% Tot.	No.	% Tot.	No.	% Tot.	No.	% Tot.
Tuberculosis	2,463	13.8	2,489	13.9	1,158	26.6	177	6.9	108	8.7	13	6.9	108	11.8	46	3.6
Cancer and Tumors	883	5.0	2,052	11.5	427	9.8	247	9.7	277	22.2	22	11.6	99	10.8	125	9.9
Typhoid Fever	1,297	7.3	256	1.4	45	1.0	27	1.1	10	0.8	4	2.1	8	0.9	8	0.6
Influenza	180	1.0	136	0.8	27	0.6	14	0.5	7	0.6	1	0.5	5	0.5	3	0.2
Diseases of Nervous System	2,018	11.3	1,536	8.6	371	8.5	329	12.9	102	8.2	25	13.2	89	9.7	194	15.3
Diseases of CirculatorySystem	1,773	10.0	2,924	16.3	651	14.9	831	32.6	277	22.2	31	16.4	190	20.8	367	29.0
Diseases of Digestive System	1,330	7.5	1,324	7.4	302	6.9	142	5.6	123	9.9	12	6.4	80	8.7	75	5.9
Diseases of Respiratory System	1,768	10.0	1,819	10.2	461	10.6	192	7.5	94	7.5	13	6.9	65	7.1	92	7.3
Insanity	268	1.5	195	1.1	47	1.0	26	1.1	10	0.8	—	—	8	0.9	64	5.1
Suicide	601	3.4	1,003	5.6	168	3.9	99	3.9	40	3.2	8	4.2	40	4.4	42	3.3
All Others	5,211	29.2	4,171	23.2	702	16.2	465	18.2	200	16.0	60	31.8	223	24.4	249	19.8
Total	17,792		17,905		4,359		2,549		1,248		189		915		1,265	

N.B. On account of differences in classification, comparison with M.-A. table is approximate only.

The striking features of the foregoing table are:

(1) The remarkably close agreement in the proportion of deaths from tuberculosis;

(2) The heavy mortality in the Swedish experience from

(*a*) Cancer and other tumors, and

(*b*) Diseases of the circulatory system; and

(3) The very low proportion in the Swedish experience of deaths from typhoid fever (including para-typhoid).

The higher rate of suicide is also rather surprising.

(*b*) *Rates of Extra Mortality.*—As already stated, the rates of extra mortality are given for each subdivided impairment group for ages at death by five-year groups and for various durations of insurance. On account of differences in the methods of classification, both as regards the composition of the groups and as regards tabulation by age and duration, it is not possible, except in certain cases, to compare with precisely analogous groups in the Medico-Actuarial investigation. So far as possible, however, an attempt has been made to bring together the more important and interesting impairments in the two investigations and, from the composition of the M.-A. groups made use of for comparison, the reader may form his own judgment of their validity. It may be noted in passing that the Swedish table is one of *extra* mortality, and where there was no extra mortality this was shown by entering simply as zero, whereas in the M.-A. tables many of the groups show mortality below the normal, or, in other words, show a negative extra mortality. Where, therefore, the figure in the Swedish table is zero, this indicates that the mortality of the group in question was as good as or better than in the normal group.

A column for "Number of Deaths" has been added in order to give some idea of the relative reliability of the figures in that respect. Many interesting impairments could not be included in the comparison because of the lack of properly comparable figures in the two investigations.

Only conclusions of a general nature are permissible in view of the differences in composition already referred to. The ratios given in Table B for the Swedish investigation would appear to confirm to a considerable extent the results of the M.A. investigation so far as they can be compared. There is, perhaps, a tendency for the Swedish figures to be lower in this class of impairments.

TABLE B.

Ratio of Total to Normal Mortality.

Impairments due to Personal History of the Insured.

Insured Has Had	Composition of Group.				Mortality Ratio.	
	Swedish.		M.-A.			
	Risk Group No.	No. of Deaths.	Risk Group No.	No. of Deaths.	Swedish.	M.-A.
1. Pneumonia or other non-tuberculous pulm. disease	T4	1,324	45	89	104	108
2. Pleurisy	T5	203	22	26	118	104–158*
			23	1,361		92–147*
3. Tuberculosis	T6	207	15	41	111	113–178*
			16	134		120–190*
4. Articular rheumatism	V4	496	25	1,366	116	109–123*
5. Stomach diseases other than ulcer	C4	317	24a	417	123	82–123*
			24b	91		90–119*
6. Albuminuria	N3	244	6	52	122	103–131*
			7	225		100–116*
7. Syphilis	L1	894	1	100	149	139–217*
	L2	304	2 & 3	174	111	129–284*
			4	67		137

* According to time elapsed since impairment was last recorded.

TABLE C.

Ratio of Total to Normal Mortality.

Impairments on account of Family History.

Impairment.	Composition of Group.				Mortality Ratio.	
	Swedish.		M.A.			
	Risk Group No.	No. of Deaths.	Risk Group No.	No. of Deaths.	Swedish.	M.A.
1. Tuberculosis:	T1	365	55	4,405	115	90–108*
One Parent	T2	422			118	
2. Tuberculosis:						
Brothers or sisters	T3	1,069	53	6,317	115	91–108*
3. Heart Disease:						
Parent	V1	584	61	233	123	113
4. Cancer:						
Parent	C1	680	60	69	110	79
Other member of family	C2	123			114	

* According to weight.

On the other hand, Table C indicates that a much more effective selection of "family history" cases is obtained in America, the M.-A. ratios being lower than the Swedish in all cases.

The large differences in the numbers of deaths in some cases, particularly in Table B, are difficult to explain, apart from the question of precise definition of the impairments. Possibly, for example, Nos. 1 and 2 in Table B should be considered together to some extent. The inclusion of "rated-up" cases has, doubtless, some bearing as well as differences in the characteristic diseases of the two countries.

For the benefit of any who may wish to make more detailed comparisons the following summary of the whole of the results of the investigation is given. The figures are taken for all ages at death combined, as no comparison in this respect with the M.-A. investigation is possible without very great labor.

TABLE D.

Ratio of Total to Normal Mortality.

Risk Group.	Insurance Years.*			
	0 to 4.	5 to 9.	10 and Over.	0 and Over.
T1.....	136.9	119.3	107.6	114.9
2.....	131.7	128.1	109.4	117.6
3.....	132.0	123.9	106.8	115.3
4.....	105.7	110.1	101.9	104.1
5.....	154.7	112.9	105.0	118.4
6.....	312.0	260.2	135.7	211.4
V1.....	119.6	121.4	124.6	123.1
2.....	116.1	122.0	126.8	124.6
3.....	153.3	159.2	162.1	160.2
4.....	117.0	112.6	115.9	115.5
C1.....	113.0	114.8	108.3	110.2
2.....	133.6	121.8	107.4	114.2
3.....	194.8	137.5	166.9	164.4
4.....	142.2	131.7	118.4	122.8
D1.....	100.4	109.1	104.9	104.8
2.....	147.1	109.2	106.1	113.2
3.....	152.5	135.3	122.9	132.2
N1.....	108.0	109.5	116.8	114.4
2.....	113.6	124.1	110.9	113.6
3.....	119.3	125.7	121.7	122.0
4.....	141.9	143.1	123.1	127.5
L1.....	148.5	173.4	144.0	149.1
2.....	121.8	124.5	106.0	111.2

* *i.e.*, in which death occurred.

Group Mortality Investigation.

BY

E. E. CAMMACK.

In December, 1919, it was decided to investigate the joint Group mortality experience of those companies willing to submit their data. An informal committee, consisting of Messrs. J. D. Craig, Mervyn Davis, J. M. Laird, J. F. Little, E. B. Morris and the writer as chairman, was formed to devise a plan to accomplish this investigation.

The writer has prepared a brief synopsis of this committee's report to the companies contributing their experience and is submitting it, believing it to be of interest to those companies writing Group insurance or contemplating doing so.

Nature of the Experience.

The whole of the Group experience of the Ætna, Connecticut General, Metropolitan, Prudential, Sun Life of Canada and Travelers has been included. The experience covers the calendar years 1913–1920, inclusive.

Group insurance is defined by law in New York State as follows:

> "Group Life insurance is that form of life insurance covering not less than fifty employees with or without medical examination, written under a policy issued to the employer, the premium on which is to be paid by the employer or by the employer and employee jointly, and insuring all of his employees, or all of any class or classes thereof determined by conditions pertaining to the employment, for amounts of insurance based upon some plan which will preclude individual selection, for the benefit of persons other than the employer, provided, however, that when the premium is to be paid by the employer and employee jointly and the benefits of the policy are offered to all eligible employees not less than seventy-five per cent. of such employees may be so insured."

Only groups of insured lives contemplated by the above definition have been included. Consequently, the experience under blanket policies, insuring the lives of members of associations and upon which the premium is paid entirely by the association out of the dues of its members, has been excluded.

All the insurance is upon the One-Year-Renewable-Term plan, and practically all is upon lives resident in the United States and Canada.

Group policies provide for payment of the full sum insured six months after receipt of proof of the total and permanent disability of the insured if such disability occurs before age 60. In this investigation cases of total and permanent disability have been counted as deaths.

Methods Used.

The experience has been compiled upon the calendar year basis.

The methods used are similar to the methods described in the paper submitted by Mr. E. B. Morris and the writer in May, 1918, on the "Joint Group Mortality Experience of the Ætna and the Travelers." But the exposures were obtained in a somewhat different way.

For each Group policy for each calendar year, the mean between what was in force at the beginning of the year and what was in force at the end of the year was taken as the total exposure for the year. This was distributed by age according to the age-distribution on the policy anniversary within the year. The exposure was obtained for quinquennial age-groups. For example, the exposure for attained ages $20\frac{1}{2}$ to $25\frac{1}{2}$ was recorded as the exposure for central age 23.

Corresponding to the exposures for central age 23, there were taken all the deaths occurring in the year where the nearest age at death was 21, 22, 23, 24 and 25.

In the calendar year in which a policy was issued, the total exposure was taken as the mean between the initial issue and what was in force at the end of the year reduced in the same proportion as the time that the policy had actually been in force bore to a full year. A similar rule was applied in getting the exposure on a policy terminated during the year.

It will be noted that this method gives, on the average, only half

a year for the year of death and that the exposure for age "x" corresponds approximately to the year of life $x - \frac{1}{2}$ to $x + \frac{1}{2}$.

Basis of Comparison.

Actual deaths have been compared with the expected by the American Men Ultimate Table. Owing to the way in which the years exposed have been recorded, the force of mortality has had to be used instead of the rate of mortality in calculating expected deaths.

Tables Submitted.

The experience has been compiled both by numbers of lives and amounts of insurance. The incidence of mortality, however, as was to be expected, did not vary appreciably according to amount of insurance. For that reason the tables shown are on the basis of lives only.

The experience, in the first place, has been separated into two general divisions:

1. For policies upon which the employer pays the whole of the premium;
2. For policies upon which the employees contribute towards the premium.

The following tables have been prepared:

Table I. Experience under policies upon which the *employer* pays the whole of premium,—*by industry*.

Table II. Experience under policies upon which the *employees* contribute towards the premium,—*by industry*.

Table III. Experience under policies upon which the *employer* pays the whole of the premium,—*by policy years*—for general classes of industry.

Table IV. Experience under policies upon which the *employees* contribute towards the premium,—*by policy years*—for general classes of industry.

Tables III and IV have been prepared because it has been suspected that mortality may increase as time elapses from the date Group insurance is adopted by an employer. This anticipation of an increasing rate of mortality has arisen from the fact that the employer has the right under his policy to continue the insurance upon any employee who becomes sick or retires, even though he is removed from the pay roll.

Under policy year "0" are recorded the years exposed and deaths for the calendar year in which a policy takes effect. The years exposed and deaths in the calendar year next following are thrown into policy year "1" and so on.

The analysis by policy years is shown for the following five general classes:

I. Mining.
II. Iron, Steel and Other Metal Industries, Lead Industry and Construction.
III. Transportation and Public Service.
IV. Clerical.
V. All Others.

The last of these general classes comprises the great volume of the experience in non-hazardous classifications.

In Table V are given for these same five general classes the years exposed by age and deaths by age and cause. This table is confined to cases in which the employer pays the entire premium. The ratio of actual to expected deaths is shown in this table for each quinquennial age group.

The analysis shown in Table V has been made for every industry or trade appearing in Table I, but the exposures do not warrant publication for each industry separately. The analysis is submitted, however, for each industry or trade with over fifty thousand years of exposure and for one or two others that seemed of especial interest.

TABLE I.

EXPERIENCE BY INDUSTRY ON GROUPS UPON WHICH EMPLOYER PAYS ENTIRE PREMIUM, CALENDAR YEARS 1913–1920.

Industry Code Number.		Years Exposed.	Actual Deaths.	Expected Deaths AM Ultimate Table.	Per Cent. of Actual to Expected.
	Agriculture.				
1	Florists and Nurserymen	553	3	5.3	
4	General Farming and All Other Agriculture	222	3	2.2	
	Total	775	6	7.5	
	Mining.				
10	Coal—Bituminous (Surface Mining)	429	3	3.7	
11	Coal—Bituminous (Underground Mining)	11,597	151	83.2	181.5
12	Coal—Anthracite	1,142	14	8.7	160.9
13	Iron (Surface Mining Only)	627	6	4.7	
14	Iron (Underground Mining Only)	2			
15	Copper (Surface Mining Only)	81	2	.7	
17	Lead and Zinc Mines (Surface Mining Only)	1,711	20	13.8	144.9
18	Lead and Zinc Mines (Underground Mining)	172	1	1.2	
19	Other Metal Mines (Surface Mining Only)	382	4	2.8	
20	Other Metal Mines (Incl. Surface and Underground)	1,278	10	10.2	98.0
21	Salt Production	464	6	4.4	
22	Minerals (Clay, Shale, Feldspar, Phosphate, Talc, etc.)	537	9	4.2	
23	Quarries (Slate, Stone, Marble)	2,744	30	21.9	137.0
	Total	21,166	256	159.5	160.5
	Oil.				
30	Mineral Oil Production, Refining and Distribution	23,506	169	181.2	93.3
	Construction.				
40	Construction (Steel, Incl. Steel Bridges)	1,211	9	8.4	107.1
41	Construction (Wood, Brick and Stone)	1,058	6	9.0	66.7
42	Shipbuilding (Iron and Steel)	61,338	533	468.0	113.9
43	Shipbuilding (Wood)	128	1	1.3	
44	Road Construction (Incl. Sewers, Bridges, etc.)	56		.3	
	Total	63,791	549	487.0	112.7

TABLE I (*Continued*).

Industry Code Number.		Years Exposed.	Actual Deaths.	Expected Deaths AM Ultimate Table.	Per Cent. of Actual to Expected.
	Iron and Steel and Other Metal Industries (Except Lead).				
60	Steel Works (With or without Rolling Mills)	10,475	104	88.7	117.2
61	Steel and Iron Foundries	68,857	656	569.2	115.2
62	Steel Rolling	8,541	100	76.6	130.5
63	Tube, Rod and Pipe Mills	19,996	180	161.1	111.7
64	Malleable Iron Works	6,535	64	61.2	104.6
65	Wire Drawing and Wire Products	17,542	138	140.3	98.4
66	Smelting (Electric Process) and Refining	543	7	4.1	
67	Other Smelting and Refining	18,226	158	143.8	109.9
68	Non-Ferrous Metal Foundries	5,650	35	41.8	83.7
	Total	156,365	1,442	1,286.8	112.1
	Metal Products.				
80	Automobiles, Aeroplanes and Agricultural Implements	85,956	544	565.1	96.3
81	Car and Railroad Shops	2,356	20	20.6	97.1
82	Sheet Metal Products (Stamping and Pressing)	35,500	241	259.6	92.8
83	Steel Fabrication (Excl. Erecting)	5,988	39	46.7	83.5
84	Drop Forging	3,042	19	25.2	75.4
85	Heavy Machinery and Other Heavy Metal Products	134,294	957	1,130.5	84.7
86	Light Metal Products (Tools, Hardware, etc.)	208,412	1,554	1,630.7	95.3
87	Light Machinery and Instruments of Precision	69,478	431	519.0	83.0
88	Boiler Making (Heavy Tanks, etc.)	10,708	77	86.1	89.4
	Total	555,734	3,882	4,283.5	90.6
	Lead Industry.				
100	Mfg. White and Red Lead—Foundry Work and Mfg. Lead Supplies incl. Batteries	615	6	6.1	
	Chemical and Allied Industries.				
110	Fertilizer Production	1,145	14	9.6	145.8
111	Paint and Varnish Factories	6,672	62	65.2	95.1
112	Aniline Dyes (Coal Tar Dyes)	120		.9	
113	Explosives	171		2.0	
114	Soap, Tallow, Glue	2,713	17	21.5	79.1
115	Heavy Acids (Sulphuric, Nitric, Hydrofluoric, etc.)	3,872	32	28.4	112.7
116	Light Acids (Acetic, Citric, etc.)	265	1	2.1	
117	General Chemical Manufacturing	8,914	68	73.8	92.1
	Total	23,872	194	203.5	95.3

TABLE I (*Continued*).

Industry Code Number.		Years Exposed.	Actual Deaths.	Expected Deaths AM Ultimate Table.	Per Cent. of Actual to Expected.
	Clay, Glass and Stone.				
130	Brick, Tile, Terra Cotta and Pottery	18,189	174	152.7	113.9
131	Glass Factories (Excl. Polished Plate Glass)	19,116	168	152.8	109.9
132	Polished Plate Glass	514	3	5.5	
133	Lime, Cement and Gypsum	5,238	39	47.6	81.9
134	Marble and Stone Yards	682	4	5.8	
	Total	43,739	388	364.4	106.5
	Clothing Industries.				
160	Hat Factories (Felt)	18,664	143	156.4	91.4
161	Furriers	4,128	17	30.0	56.7
162	All Other Clothing	42,298	227	297.0	76.4
	Total	65,090	387	483.4	80.1
	Food and Kindred Industries.				
180	Dairy Products	5,673	24	41.5	57.8
181	Flour and Grain Mills and Elevators	9,976	65	86.2	75.4
183	Canneries (Meat, Fruit and Vegetables)	17,843	109	124.9	87.3
184	Slaughter and Packing Houses and Stock Yards	9,726	80	81.4	98.3
185	Sugar Factories and Refineries	11,089	89	88.6	100.5
186	Manufacturing and Bottling Beverages	685	3	6.6	
187	Cereals, Prepared Food, Bakeries, Confectionery and All Other Food Products	22,344	136	171.2	79.4
	Total	77,336	506	600.4	84.3
	Leather Industries (Excluding Artificial Leather).				
200	Heavy Leather Goods	4,895	52	42.2	123.2
201	Shoes and Other Light Leather Goods	49,759	318	357.5	89.0
202	Tanneries	18,899	169	168.5	100.3
	Total	73,553	539	568.2	94.9
	Lumber and Furniture.				
220	Woodsmen and Loggers	2,769	39	23.6	165.3
221	Lumber Yards and Saw and Planing Mills	21,779	162	214.0	75.7

TABLE I (*Continued*).

Industry Code Number.		Years Exposed.	Actual Deaths.	Expected Deaths AM Ultimate Table.	Per Cent. of Actual to Expected.
	Lumber and Furniture (Continued)				
222	Furniture and Woodworking (Carriages and Musical Instruments)	99,498	699	909.9	76.8
	Total	124,046	900	1,147.5	78.4
	Paper and Pulp Manufacturing.				
240	Paper and Ground Wood Pulp Mills	16,946	121	149.7	80.8
241	Sulphide Soda Pulp Mills	5,973	53	53.4	99.3
242	Paper Boxes	18,741	114	126.3	90.3
243	All Other Paper Manufacturing	25,541	170	215.5	78.9
	Total	67,201	458	544.9	84.1
	Printing.				
260	Printing, Bookbinding and Publishing	44,055	351	356.5	98.5
	Textile Industries.				
270	Bleaching, Dyeing, Printing and Finishing	39,508	317	353.7	89.6
271	Hemp, Jute, Rope and Cordage	25,285	190	198.3	95.8
272	All Other Textiles (Wool, Cotton, Silk, etc.)	305,935	1,984	2,319.1	85.6
	Total	370,728	2,491	2,871.1	86.8
	Miscellaneous Industries.				
290	Artificial Leather (Using Pyroxylin Composition)	1,171	14	9.9	141.4
291	Cigars and Tobacco	3,385	28	25.3	110.7
292	Electric Cables and Supplies (Not falling under Class 100)	46,063	241	307.3	78.4
293	Rubber	78,183	434	479.8	90.5
294	Brooms and Brushes	2,350	21	19.8	106.1
295	Buttons (Excl. Metal, Rubber and Composition)	1,181	5	7.9	63.3
296	Celluloid and Celluloid Articles (Pyroxylin Composition)	619	4	4.2	
297	Drugs (Sundries, incl. Soaps, Perfumes)	23,424	145	171.0	84.8
298	Cottonseed Oil Production (and Other Vegetable Oil Products)	261	1	2.0	

TABLE I (*Continued*).

Industry Code Number.		Years Exposed.	Actual Deaths.	Expected Deaths AM Ultimate Table.	Per Cent of Actual to Expected.
	Miscellaneous Industries (Cont.),				
299	Ice (Manufacturing, Harvesting and Distributing)	4,637	46	45.5	101.1
300	Miscellaneous	20,827	181	169.0	107.1
	Total	182,101	1,120	1,241.7	90.2
	Transportation and Public Service				
330	Water Transportation (Employees on Vessels other than River)	199		1.1	
331	Water Transportation (Harbor, Dock and River Vessel Employees)	403	4	2.7	
332	Electric and Street Railroads	17,203	170	157.9	107.7
333	Livery Stables, Auto Service Stations, Bus, Cab, Truck, Transfer, etc	6,766	46	41.0	112.2
334	Steam Railroads	579	1	4.7	
335	Express Companies	150		1.0	
337	Telephone	1,039	6	5.4	111.1
338	Subway and Elevated Railroads	6,081	75	43.2	173.6
339	Police	1,811	21	17.1	
340	Firemen	561	3	4.2	
341	Gas Works	2,409	18	20.2	89.1
342	Electric Light and Power	28,921	252	200.7	125.6
	Total	66,122	596	499.2	119.4
	Clerical and Professional.				
360	Clerical (Banks, Insurance and Other Office Forces)	156,026	843	1,043.9	80.8
361	Medical, Nurses, Sanitaria, Hospitals, etc	535	2	3.4	
362	Theatrical	1,171	11	8.0	137.5
	Total	157,732	856	1,055.3	81.1
	Trade and Public Service.				
370	Wholesale Merchants and Dealers	42,164	279	338.2	82.5
371	Retail	76,977	501	588.6	85.1
372	Warehouses and Cold Storage Plants	2,738	19	23.1	82.3
373	Hotels and Restaurants	12,676	115	99.7	115.3
374	Laundries (Incl. Dry Cleaning)	4,532	32	32.3	99.1
375	Coal Delivery	3,467	44	33.6	131.0
	Total	142,554	990	1,115.5	88.7
	TOTAL—ALL INDUSTRIES	2,260,081	16,086	17,463.2	92.1

TABLE II.

EXPERIENCE BY INDUSTRY ON GROUPS UPON WHICH EMPLOYER AND EMPLOYEE PAY PREMIUMS JOINTLY, CALENDAR YEARS 1913–1920.

Industry Code Number.		Years Exposed.	Actual Deaths.	Expected Deaths AM Ultimate Table.	Per Cent. of Actual to Expected.
	Mining.				
11	Coal—Bituminous (Underground Mining)	143	1	1.1	
	Iron and Steel and Other Metal Industries (Except Lead).				
60	Steel Works (Open Hearth, Bessemer, Crucible, etc.)	185		2.0	
62	Steel Rolling	1,086	11	7.7	142.9
65	Wire Drawing and Wire Products	64		.4	
	Total	1,335	11	10.1	108.9
	Metal Products.				
82	Sheet Metal Products (Stamping and Pressing)	1,431	7	9.1	76.9
83	Steel Fabrication (Excl. Erecting)	155	3	1.2	
85	Heavy Machinery and Other Heavy Metal Products)	2,341	15	18.6	80.6
86	Light Metal Products (Tools, Hardware, etc.)	2,400	19	20.5	92.7
87	Light Machinery and Instruments of Precision)	220		1.6	
	Total	6,547	44	51.0	86.3
	Chemical and Allied Industries.				
114	Soap, Tallow and Glue	266	1	2.3	
117	General Chemical Manufacturing	2,657	33	17.2	191.9
	Total	2,923	34	19.5	174.4
	Food and Kindred Industries.				
184	Slaughter and Packing Houses and Stock Yards	46		.3	
	Lumber and Furniture.				
221	Lumber Yards and Saw and Planing Mills	15		.1	
222	Furniture and Woodworking	10		.1	
	Total	25		.2	

TABLE II (*Continued*).

Industry Code Number.		Years Exposed.	Actual Deaths.	Expected Deaths AM Ultimate Table.	Per Cent. of Actual to Expected.
	Paper and Pulp Manufacturing.				
240	Paper and Ground Wood Pulp Mills	417	2	3.1	
243	All Other Paper Manufacturing	1,175	1	8.6	11.6
	Total	1,592	3	11.7	25.6
	Printing.				
260	Printing, Bookbinding and Publishing	2,870	17	17.8	95.5
	Textile Industries.				
270	Bleaching, Dyeing, Printing and Finishing	7,532	56	68.5	81.8
272	All Other Textiles (Wool, Cotton, Silk, etc.)	7,388	39	57.7	67.6
	Total	14,920	95	126.2	75.3
	Miscellaneous Industries.				
292	Electric Cables and Supplies	1,210	6	6.6	90.9
300	Miscellaneous	461	9	4.5	200.0
	Total	1,671	15	11.1	135.1
	Transportation and Public Service.				
332	Electric and Street Railroads	66,563	882	619.4	142.4
333	Livery Stables, Auto Service Stations, etc.	119	2	.8	
334	Steam Railroads	114	1	.8	
340	Firemen	135	2	1.3	
341	Gas Works	21,263	286	226.3	126.4
342	Electric Light and Power	84	1	.7	
	Total	88,278	1,174	849.3	138.2
	Clerical and Professional.				
360	Clerical (Banks, Insurance, etc.)	30,638	175	195.5	89.5
	Trade and Service.				
371	Retail Merchants and Dealers	558	1	3.5	
373	Hotels and Restaurants	24		.2	
	Total	582	1	3.7	
	GRAND TOTAL—ALL INDUSTRIES.	151,570	1,570	1,297.5	121.0

TABLE III.

EXPERIENCE BY POLICY YEARS ON GROUPS UPON WHICH THE EMPLOYER PAYS THE ENTIRE PREMIUM, CALENDAR YEARS 1913–1920.

Policy Years.	Years Exposed.	Actual Deaths.	Expected Deaths AM Ultimate Table.	Per Cent. of Actual to Expected.
Class I—Mining.				
0.....	7,421	99	56.7	174.6
1.....	8,366	97	63.2	153.5
2.....	5,242	58	38.3	151.4
3.....	137	2	1.3	
Total.	21,166	256	159.5	160.5
Class II—Iron, Steel and Other Metal Industries, Lead Industry and Construction.				
0.....	37,240	327	381.4	85.7
1.....	83,286	873	686.6	127.1
2.....	55,199	509	433.6	117.4
3.....	39,025	229	230.6	99.3
4.....	5,651	56	44.6	125.6
5.....	370	3	3.1	
Total.	220,771	1,997	1,779.9	112.2
Class III—Transportation and Public Service.				
0.....	14,743	99	109.7	90.2
1.....	19,836	181	146.9	123.2
2.....	11,558	118	87.5	134.9
3.....	9,738	110	83.7	131.4
4.....	7,424	58	51.7	112.2
5.....	2,823	30	19.7	152.3
Total.	66,122	596	499.2	119.4
Class IV—Clerical.				
0.....	34,767	149	234.3	63.6
1.....	49,971	282	350.4	80.5
2.....	22,046	160	146.7	109.1
3.....	16,300	86	110.0	78.2
4.....	10,102	63	67.4	93.5
5.....	6,586	38	40.8	93.1
6.....	9,180	39	57.0	68.4
7.....	7,074	26	37.3	69.7
Total.	156,026	843	1,043.9	80.8
Class V—All Others.				
0.....	472,388	2,623	3,610.4	72.7
1.....	626,176	4,673	5,009.5	93.3
2.....	317,173	2,282	2,520.9	90.5
3.....	194,379	1,527	1,548.1	98.6
4.....	76,020	555	562.1	98.7
5.....	39,728	324	277.0	117.0
6.....	36,092	181	238.5	75.9
7.....	34,040	229	214.2	106.9
Total.	1,795,996	12,394	13,980.7	88.7

TABLE III (*Continued*),

Policy Years.	Years Exposed.	Actual Deaths.	Expected Deaths AM Ultimate Table.	Per Cent. of Actual to Expected.
		All Classes.		
0.....	566,559	3,297	4,392.5	75.1
1.....	787,635	6,106	6,256.6	97.6
2.....	411,218	3,127	3,227.0	96.9
3.....	259,579	1,954	1,973.7	99.0
4.....	99,197	732	725.8	100.9
5.....	49.507	395	340.6	116.0
6.....	45,272	220	295.5	74.5
7.....	41,114	255	251.5	101.4
Total.	2,260,081	16,086	17,463.2	92.1

TABLE IV

EXPERIENCE BY POLICY YEARS ON GROUPS UPON WHICH EMPLOYER AND EMPLOYEES PAY PREMIUM JOINTLY, CALENDAR YEARS 1913–1920.

Policy Years.	Years Exposed.	Actual Deaths.	Expected Deaths AM Ultimate Table.	Per Cent. of Actual to Expected.
Class I—Mining.				
0.....	143	1	1.1	
Class II—Iron, Steel and Other Metal Industries, Lead Industry and Construction.				
0.....	626	4	5.0	
1.....	709	7	5.1	
Total.	1,335	11	10.1	108.9
Class III—Transportation and Public Service.				
0.....	9,793	145	91.3	158.8
1.....	22,552	228	215.7	105.7
2.....	22,959	294	221.2	132.9
3.....	11,381	176	112.0	157.1
4.....	10,969	185	112.1	165.0
5.....	6,005	94	61.9	151.9
6.....	2,197	26	17.1	152.0
7.....	2,422	26	18.0	144.4
Total.	88,278	1,174	849.3	138.2
Class IV—Clerical.				
0.....	1,937	8	11.7	68.4
1.....	5,509	24	34.5	69.6
2.....	5,030	24	32.7	73.4
3.....	4,079	30	26.0	115.4
4.....	4,050	35	26.0	134.6
5.....	4,680	24	30.1	79.7
6.....	5,353	30	34.5	87.0
Total.	30,638	175	195.5	89.5
Class V—All Others.				
0.....	12,015	67	84.1	79.7
1.....	8,617	56	63.4	88.3
2.....	3,514	31	29.2	106.2
3.....	2,373	13	22.1	58.8
4.....	2,041	23	18.7	123.0
5.....	1,286	9	11.5	78.3
6.....	1,330	10	12.5	80.0
Total.	31,176	209	241.5	86.5
All Classes.				
0.....	24,514	225	193.2	116.5
1.....	37,387	315	318.7	98.8
2.....	31,503	349	283.1	123.3
3.....	17,833	219	160.1	136.8
4.....	17,060	243	156.8	155.0
5.....	11,971	127	103.5	122.7
6.....	8,880	66	64.1	103.0
7.....	2,422	26	18.0	144.4
Total.	151,570	1,570	1,297.5	121.0

TABLE V.

EXPERIENCE BY ATTAINED AGE WITH ANALYSIS OF DEATHS BY CAUSE, ENTIRE PREMIUM PAID BY EMPLOYER, CALENDAR YEARS 1913–1920.

Class I—Mining.

Central Age.	Years Exposed.	Number of Deaths and Cases of Total and Permanent Disability.																	
		All Causes.	Ratio of Actual to Expected, AM Ult. Table.	Typhoid.	Influenza.	Rheumatism.	Cancer and other Malignant Tumors.	Tuberculosis.	Diabetes.	Diseases of Brain and Nervous System.	Diseases of Heart and Circulatory System.	Diseases of Respiratory System.	Cirrhosis of Liver.	Diseases of Digestive System.	Genito-Urinary and Prostate Diseases.	Accident.	Suicide.	Other Causes.	Total and Permanent Disability.
18.....	2,303	18	211.8		2							3				11		2	
23.....	3,004	26	206.3		4					1	2	2				17			
28.....	3,175	35	250.0	1	3			1		1	2	4		1		15		6	1
33.....	3,059	25	177.3		4			1			1	4			1	14			
38.....	3,064	43	270.4		8			8		2	4	5		1	1	11		2	1
43.....	2,140	29	198.6		5		1	2		1	2	6		1	1	8	1	1	
48.....	1,861	24	134.1	1	1		1			2		5		1	1	6		4	2
53.....	1,177	21	125.0		2			1		2	5	2		2	1	4		1	1
58.....	788	9	52.3					1		1	1	1		1	2			1	1
63.....	349	14	119.7							2	3	3		2	1	1		2	
68.....	161	8	96.4		1					2	2	1		1				1	
73.....	63	3	61.2							1	1	1							
78.....	14	1	58.8							1									
83.....	7																		
88.....	1																		
Total..	21,166	256	160.5	2	30		2	14		16	23	37		10	8	87	1	20	6

TABLE V (*Continued*).

EXPERIENCE BY ATTAINED AGE WITH ANALYSIS OF DEATHS BY CAUSE, ENTIRE PREMIUM PAID BY EMPLOYER, CALENDAR YEARS 1913–1920.

Class II—Iron, Steel and Other Metal Industries, Lead Industry and Construction.

Central Age	Years Exposed.	Number of Deaths and Cases of Total and Permanent Disability.																	
		All Causes.	Ratio of Actual to Expecte AM Ult. Table	Typhoid.	Influenza.	Rheumatism.	Cancer and Other Malignant Tumors.	Tuberculosis.	Diabetes.	Diseases of Brain and Nervous System.	Diseases of Heart and Circulatory System.	Diseases of Respiratory System.	Cirrhosis of Liver.	Diseases of Digestive System.	Genito-Urinary and Prostate Disease.	Accident.	Suicide.	Other Causes.	Total and Permanent Disability.
18....	16,632	74	120.3		21			8	1	5	3	14		4		16	1	1	
23....	28,720	152	126.0	3	48			17	1	2	7	31		5	3	27	2	6	
28....	35,324	225	144.8	5	86		4	14		9	7	47	1	7	2	31	2	8	2
33....	35,281	260	160.2	2	82		5	28	2	9	10	67	1	7	6	30	3	5	3
38....	31,267	240	147.6	3	62	2	4	23	1	9	19	62		7	9	30	3	3	3
43....	23,200	193	122.3	1	23	1	6	17	1	10	31	54	2	6	4	26	2	7	2
48....	19,922	217	113.4	2	22		16	18		21	18	47	2	9	19	26	4	11	2
53....	13,330	188	98.6		12		16	13	3	15	25	40	5	9	16	19	4	9	2
58....	8,665	165	87.3		8	1	16	3		16	37	35	2	8	16	10	2	7	4
63....	4,875	130	79.6	1	5		19	3	4	12	33	20	1	5	11	9	1	6	
68....	2,416	84	67.8		3		18	2	1	10	15	17	1	5	6	4	1	1	
73....	909	55	77.4				3		2	11	15	7	1		9	2		5	
78....	192	11	48.2				1			2	2	1			4			1	
83....	30	2	37.0								1	1							
88....	8	1									1								
Total.	220,771	1,997	112.2	17	372	4	108	146	16	131	224	443	16	72	105	230	25	70	18

TABLE V (*Continued*).

EXPERIENCE BY ATTAINED AGE WITH ANALYSIS OF DEATHS BY CAUSE, ENTIRE PREMIUM PAID BY EMPLOYER, CALENDAR YEARS 1913–1920.

Class III—Transportation and Public Service.

Central Age.	Years Exposed.	Number of Deaths and Cases of Total and Permanent Disability.																	
		All Causes.	Ratio of Actual to Expected AM Ult. Table.	Typhoid.	Influenza.	Rheumatism.	Cancer and Other Malignant Tumors.	Tuberculosis.	Diabetes.	Diseases of Brain and Nervous System.	Diseases of Heart and Circulatory System.	Diseases of Respiratory System.	Cirrhosis of Liver.	Diseases of Digestive System.	Genito-Urinary and Prostate Diseases.	Accident.	Suicide.	Other Causes.	Total and Permanent Disability.
18....	4,076	16	106.0	1	1			3	1	1	1	2		2		4			
23....	9,293	57	146.2	2	8			8		1	1	6		4	1	24	1	1	
28....	12,285	88	162.7		14			9	2	3	3	16		2	3	28	3	5	
33....	11,312	76	146.2		19		1	11	1	2	8	9		1	3	16	2	3	
38....	9,246	77	160.1	1	4		4	6		3	9	11		4	6	23	4	2	
43....	6,869	49	104.9	1	3	1	2	5		3	6	8	1	3	5	9		2	
48....	5,037	60	124.0		5		5	8	1	5	8	8	1	3	3	10	1	2	
53....	3,624	53	102.3		1		8	3		10	8	5	3	5	6	2		2	
58....	2,250	42	85.5		2		6	1		1	6	7		4	4	8	2	1	
63....	1,322	38	85.8		1		5		1	2	11	11			2	3		2	
68....	562	25	86.6		3						8	5			5	1	2	1	
73....	197	10	64.9				1			1	3			1	3			1	
78....	44	4	76.9							2	2								
83....	5	1													1				
88....																			
Total.	66,122	596	119.4	5	61	1	32	54	6	34	74	88	5	29	42	128	15	22	

TABLE V (*Continued*).

EXPERIENCE BY ATTAINED AGE WITH ANALYSIS OF DEATHS BY CAUSE, ENTIRE PREMIUM PAID BY EMPLOYER, CALENDAR YEARS 1913–1920.

Class IV—Clerical.

Central Age.	Years Exposed.	Number of Deaths and Cases of Total and Permanent Disability.																	
		All Causes.	Ratio of Actual to Expected AM Ult. Table.	Typhoid.	Influenza.	Rheumatism.	Cancer and Other Malignant Tumors.	Tuberculosis.	Diabetes.	Diseases of Brain and Nervous System.	Diseases of Heart and Circulatory System.	Diseases of Respiratory System.	Cirrhosis of Liver.	Diseases of Digestive System.	Genito-Urinary and Prostate Diseases.	Accident.	Suicide.	Other Causes.	Total and Permanent Disability.
18....	20,277	59	78.7	1	7			13	1	3	3	13		5		12		1	
23....	32,000	91	67.7	2	9		2	25		1	7	14		5	2	15	1	7	1
28....	26,621	89	76.0	5	16			17	2	2	9	17		6	1	9	1	4	
33....	21,522	91	91.9		24		2	10	2	5	11	17		5	2	8	1	2	2
38....	17,572	86	94.1	1	12	1	4	10		7	5	17		6	4	10	2	6	1
43....	13,929	64	67.6	1	6			5	1	7	9	11	1	7	8	4	3	1	
48....	10,552	80	79.0		5		12	7	1	6	12	10	1	8	9	2	1	5	1
53....	6,401	89	97.3		3		7	8	2	10	20	14		4	11	4		6	
58....	3,805	78	94.1		2	1	8	4		9	18	12		5	12		2	4	1
63....	2,036	50	73.3		1		5	2	2	11	14	8		1	3	3			
68....	811	36			2		5			7	8	2	1	1	8	2			
73....	368	21					5			1	4	1		2	5	1		2	
78....	100	7									4	1			2				
83....	29	2			1						1								
88....	3																		
Total.	156,026	843	80.8	10	88	2	50	101	11	69	125	137	3	55	67	70	11	38	6

TABLE V (*Continued*).

EXPERIENCE BY ATTAINED AGE WITH ANALYSIS OF DEATHS BY CAUSE, ENTIRE PREMIUM PAID BY EMPLOYER, CALENDAR YEARS 1913–1920.

Class V—All Other Industries.

Central Age.	Years Exposed.	Number of Deaths and Cases of Total and Permanent Disability.																	
		All Causes.	Ratio of Actual to Expected AM Ult. Tab.e.	Typhoid.	Influenza.	Rheumatism.	Cancer and Other Malignant Tumors.	Tuberculosis.	Diabetes.	Diseases of Brain and Nervous System.	Diseases of Heart and Circulatory System.	Diseases of Respiratory System.	Cirrhosis of Liver.	Diseases of Digestive System.	Genito-Urinary and Prostate Diseases.	Accident.	Suicide.	Other Causes.	Total and Permanent Disability.
18....	269,120	838	84.2	43	157	3	5	131	5	42	52	129	2	61	29	119	2	49	9
23....	288,986	1,050	86.5	31	190	1	10	214	7	40	57	184		63	26	140	10	68	9
28....	271,681	1,272	106.4	21	353	1	16	186	11	48	69	260	4	68	33	120	14	61	7
33....	239,881	1,298	117.6	20	289		29	190	9	53	86	277	2	64	51	131	19	67	11
38....	207,046	1,200	111.5	14	177	3	44	168	12	62	138	214	12	60	73	103	16	79	25
43....	158,614	1,100	102.0	12	122		63	111	13	77	144	177	11	75	84	96	24	73	18
48....	130,824	1,135	90.4	8	90	1	107	105	10	103	171	174	14	69	104	90	12	55	22
53....	93,505	1,134	84.8	11	61		112	77	17	122	199	163	13	75	102	73	16	58	35
58....	65,637	1,166	81.5	1	37	2	130	57	18	149	238	177	12	56	121	77	13	44	34
63....	40,263	897	66.5	1	39	1	111	32	14	122	221	111	10	33	104	45	7	46	
68....	20,684	766	72.2		17	2	82	24	8	118	201	99	11	29	104	34	5	32	
73....	7,442	389	66.8	1	15	1	38	3	3	67	114	52	2	12	45	20	1	15	
78....	1,963	113	48.6		3		12			19	36	16		5	15	2		5	
83....	294	33			3		1			5	8	6		2	4	2		2	
88....	51	2								1		1							
93....	4	1													1				
98....	1																		
Total.	1,795,996	12,394	88.7	163	1553	15	760	1298	127	1028	1734	2040	93	672	896	1052	139	654	170

TABLE V (*Continued*).

EXPERIENCE BY ATTAINED AGE WITH ANALYSIS OF DEATHS BY CAUSE, ENTIRE PREMIUM PAID BY EMPLOYER, CALENDAR YEARS 1913–1920.

Shipbuilding, Iron and Steel (Industry Code No. 42).

Central Age.	Years Exposed.	Number of Deaths and Cases of Total and Permanent Disability.																	
		All Causes.	Ratio of Actual to Expected AM Ult. Table.	Typhoid.	Influenza.	Rheumatism.	Cancer and Other Malignant Tumors.	Tuberculosis.	Diabetes.	Diseases of Brain and Nervous System.	Diseases of Heart and Circulatory System.	Diseases of Respiratory System.	Cirrhosis of Liver.	Diseases of Digestive System.	Genito-Urinary and Prostate Diseases.	Accident.	Suicide.	Other Causes.	Total and Permanent Disability.
18....	5,776	37	172.9		10			3	1	3	1	7		2		8	1	1	
23....	8,619	47	129.8	3	20			5		1	2	6		2		8			
28....	9,847	79	182.4	2	41		2	5		4	1	9		3	1	10		1	
33....	9,656	71	159.9		32		1	5	1	1	1	16	1	2	1	10			
38....	8,157	69	162.7		16			6	1	2	7	18		3	3	12	1		
43....	6,217	51	120.6	1	5		1	5			11	8	1	1	1	12	1	3	1
48....	5,444	47	89.9	1	4		5	7		3	4	6		1	4	7	1	4	
53....	3,515	43	85.5		5		5	3		2	2	8	3		7	4		4	
58....	2,178	39	82.1		1	1	2			5	8	9	1	1	4	3		3	1
63....	1,119	20	53.3		3					2	4	2		2	4	3			
68....	568	16			2		4			2	3	2		1	1	1			
73....	199	12					1		1	2	2	1			4	1			
78....	35	1													1				
83....	6	1										1							
88....	2																		
Total.	61,338	533	113.9	7	136	1	24	39	4	27	46	93	6	18	31	79	4	16	2

TABLE V (*Continued*).

EXPERIENCE BY ATTAINED AGE WITH ANALYSIS OF DEATHS BY CAUSE, ENTIRE PREMIUM PAID BY EMPLOYER, CALENDAR YEARS 1913–1920.

Steel and Iron Foundries (Industry Code No. 61).

Central Age.	Years Exposed.	Number of Deaths and Cases of Total and Permanent Disability.																	
		All Causes.	Ratio of Actual to Expected AM Ult. Table.	Typhoid.	Influenza.	Rheumatism.	Cancer and Other Malignant Tumors.	Tuberculosis.	Diabetes.	Diseases of Brain and Nervous System.	Diseases of Heart and Circulatory System.	Diseases of Respiratory System.	Cirrhosis of Liver.	Diseases of Digestive System.	Genito-Urinary and Prostate Diseases.	Accident.	Suicide.	Other Causes.	Total and Permanent Disability.
18....	4,602	20	117.6		9					1		6		1		3			
23....	8,516	49	136.9		12			8	1	1	2	15				7		3	
28....	10,853	72	150.6		31		1	2		3	1	22		2		8		2	
33....	11,328	78	149.7		24		2	12	1	2	3	25		2		5	1		1
38....	10,287	71	132.7	1	16	1	1	3		6	3	27		2		6	1	2	2
43....	7,222	67	136.5		10		1	4		4	10	24		3	3	4	1	2	1
48....	6,263	78	129.8		11		5	5		7	4	24		4	7	4	3	4	
53....	4,218	66	109.5		5		4	5		4	14	17	1	7		5	1	2	1
58....	2,703	51	86.6		6		4	1		2	7	17		3	3	2	2	3	1
63....	1,625	49	90.1		4		8	3		4	12	10	1		3	2		2	
68....	805	30			1		8	2		3	7	4		2		2	1		
73....	347	20					1		1	5	6	1	1		2			3	
78....	71	3					1					1			1				
83....	14	1									1								
88....	3	1									1								
Total.	68,857	656	115.2	1	129	1	36	45	3	42	71	193	3	26	19	48	10	23	6

TABLE V (*Continued*).

EXPERIENCE BY ATTAINED AGE WITH ANALYSIS OF DEATHS BY CAUSE, ENTIRE PREMIUM PAID BY EMPLOYER, CALENDAR YEARS 1913–1920.

Automobiles, Aeroplanes and Agricultural Implements (*Industry Code No. 80*).

Central Age.	Years Exposed.	Number of Deaths and Cases of Total and Permanent Disability.																	
		All Causes.	Ratio of Actual to Expected AM Ult. Table.	Typhoid.	Influenza.	Rheumatism.	Cancer and Other Malignant Tumors.	Tuberculosis.	Diabetes.	Diseases of Brain and Nervous System.	Diseases of Heart and Circulatory System.	Diseases of Respiratory System.	Cirrhosis of Liver.	Diseases of Digestive System.	Genito-Urinary and Prostate Diseases.	Accident.	Suicide.	Other Causes.	Total and Permanent Disability.
18....	5,457	19	94.1		4			3		2	1	2		1	1	4		1	
23....	15,904	50	74.9	1	6			9		3	1	13		6		7	1	3	
28....	18,755	77	93.3	3	13			8		7	5	20		4	1	10	1	4	1
33....	15,026	85	123.0		9		2	16		1	4	29		6	2	9	3	4	
38....	11,806	83	135.2	1	7		3	12	2	2	13	20	1	5	3	3	4	6	1
43....	7,206	49	100.0		2		2	3		3	4	10	1	2	5	8	2	7	
48....	5,317	46	90.2	1	7		2	6	2	3	4	11	1		3	4	1	1	
53....	2,894	37	89.4	1	1		2	3	1		9	7	2	4	5	1			1
58....	1,766	41	106.5		1		5		3	4	8	9		3	4	3	1		
63....	1,019	23	67.4		2		2			4	2	4		3	2		1	3	
68....	555	19					1			7	1	4			3	1		2	
73....	195	11			1		1			2	3			1	1	1		1	
78....	49	4									2				1			1	
83....	5																		
88....	2																		
Total.	85,956	544	96.3	7	53		20	60	8	38	57	129	5	35	31	51	14	33	3

TABLE V (*Continued*).

EXPERIENCE BY ATTAINED AGE WITH ANALYSIS OF DEATHS BY CAUSE, ENTIRE PREMIUM PAID BY EMPLOYER, CALENDAR YEARS 1913–1920.

Heavy Machinery and Other Heavy Metal Products (Industry Code No. 85).

Central Age.	Years Exposed.	Number of Deaths and Cases of Total and Permanent Disability.																	
		All Causes.	Ratio of Actual to Expected AM Ult. Table.	Typhoid.	Influenza.	Rheumatism.	Cancer and Other Malignant Tumors.	Tuberculosis.	Diabetes.	Diseases of Brain and Nervous System.	Diseases of Heart and Circulatory System.	Diseases of Respiratory System.	Cirrhosis of Liver.	Diseases of Digestive System.	Genito-Urinary and Prostate Diseases.	Accident.	Suicide.	Other Causes.	Total and Permanent Disability.
18....	12,867	41	86.1	1	5			7		2	6	4		4	1	8	1	2	
23....	19,470	64	78.2	5	10	1	1	11	2	3	5	12		4	1	7		1	1
28....	19,830	90	103.1		20		1	16	1	1	5	21	2	5	1	10	2	5	
33....	19,009	96	109.8		32		3	7		4	4	20		4	7	8		7	
38....	17,212	97	108.4		10		2	19	1	3	7	20	1	5	8	8	2	11	
43....	13,551	97	105.3		11		8	12	2	6	13	13		7	4	9	2	9	1
48....	11,483	96	87.1	2	6		7	12		9	15	24	3	5	5	4	1	3	
53....	8,662	109	88.0		4		7	11	4	11	22	21		8	7	4	1	7	2
58....	6,057	114	86.4		4		15	3	2	12	22	24	3	5	9	8	2	4	1
63....	3,661	57	46.5		3		5	2	1	6	19	5		3	7	2		4	
68....	1,731	57	64.2		3		6	2	1	8	9	10		3	9	2	1	3	
73....	611	27	56.5		1		1			4	10	5			4	1		1	
78....	132	8	51.3		1		1			1	1	3			1				
83....	15	4	148.1		1						1	1		1					
88....	1																		
93....	2																		
Total.	134,294	957	84.7	8	111	1	57	102	14	70	139	183	9	54	64	71	12	57	5

TABLE V (*Continued*).

EXPERIENCE BY ATTAINED AGE WITH ANALYSIS OF DEATHS BY CAUSE, ENTIRE PREMIUM PAID BY EMPLOYER, CALENDAR YEARS 1913–1920.

Light Metal Products (Tools, Hardware, Etc.) (Industry Code No. 86).

Central Age.	Years Exposed.	Number of Deaths and Cases of Total and Permanent Disability.																	
		All Causes.	Ratio of Actual to Expected AM Ult. Table.	Typhoid.	Influenza.	Rheumatism.	Cancer and Other Malignant Tumors.	Tuberculosis.	Diabetes.	Diseases of Brain and Nervous System.	Diseases of Heart and Circulatory System.	Diseases of Respiratory System.	Cirrhosis of Liver.	Diseases of Digestive System.	Genito-Urinary and Prostate Diseases.	Accident.	Suicide.	Other Causes.	Total and Permanent Disability.
18....	29,268	93	85.9	2	18			14	1	5	2	19		6	4	18		2	2
23....	33,353	120	85.7	1	32		1	28		3	4	19		8	1	8	3	12	
28....	31,353	184	133.3	1	68		4	23	1	5	5	38		13	2	12	2	7	3
33....	28,638	180	136.7	2	48		5	22		6	9	42		9	2	16	6	10	3
38....	24,338	171	135.1	1	28		4	23	2	15	20	30		9	6	12	3	10	8
43....	18,793	131	102.5	1	20		7	13	1	7	14	28	3	4	11	6	3	6	7
48....	15,621	152	101.3		18		19	19	1	9	19	24	3	5	10	11	1	8	5
53....	11,334	143	88.2	1	10		13	8	1	12	23	23	3	7	16	7	5	7	7
58....	7,574	108	65.4		4	1	13	6		13	22	15	2	4	12	5		5	6
63....	4,600	118	76.6		5		14	5	2	22	26	18	1	3	10	6	1	5	
68....	2,392	85	69.3		3		15	1	2	11	15	15	5	4	10	1	1	2	
73....	861	48			4		4			14	11	5		2	4	4			
78....	247	17					2			2	9	1		2	1				
83....	34	3					1			1	1								
88....	6	1										1							
Total.	208,412	1,554	95.3	9	258	1	102	162	11	125	180	278	17	76	89	106	25	74	41

TABLE V (*Continued*).

EXPERIENCE BY ATTAINED AGE WITH ANALYSIS OF DEATHS BY CAUSE, ENTIRE PREMIUM PAID BY EMPLOYER, CALENDAR YEARS 1913–1920.

Light Machinery and Instruments of Precision (Industry Code No. 87).

Central Age.	Years Exposed.	Number of Deaths and Cases of Total and Permanent Disability.																	
		All Causes.	Ratio of Actual to Expected AM Ult. Table.	Typhoid.	Influenza.	Rheumatism.	Cancer and Other Malignant Tumors.	Tuberculosis.	Diabetes.	Diseases of Brain and Nervous System.	Diseases of Heart and Circulatory System.	Diseases of Respiratory System.	Cirrhosis of Liver.	Diseases of Digestive System.	Genito-Urinary and Prostate Diseases.	Accident.	Suicide.	Other Causes.	Total and Permanent Disability.
18....	10,295	31	81.4		5		1	5	1	2	3	2		2	2	7	1		
23....	12,208	43	83.8	2	7		1	15		2	1	2		2	2	4	2	3	
28....	11,765	41	79.2	1	10		1	4		1	4	11		1	2	4	1	1	
33....	9,811	43	95.3	1	7			9	1	2	3	11			2	6		1	
38....	7,457	40	103.1		2		2	4	1	4	8	9	1		2	3	1	1	2
43....	5,446	37	100.0				1	5	1	2	9	3	2	2	3	4	1	2	2
48....	4,464	41	95.6		4		5	3	1	2	3	4		4	6	6		1	2
53....	3,245	42	90.5		4		7	4		4	7	4	2	2	3		1	1	3
58....	2,295	41	82.0		1		4	3	1	8	11	2	1	2	3	3		1	1
63....	1,427	31	64.9				1		1	4	12	4		2	4	1		2	
68....	714	23			1		6	1		2	4	1		2	4	2			
73....	252	12					3				4	1			3	1			
78....	77	6					1			2	1	2							
83....	17																		
88....	5																		
Total.	69,478	431	83.0	4	41		33	53	7	35	70	56	6	19	36	41	7	13	10

TABLE V (*Continued*).

EXPERIENCE BY ATTAINED AGE WITH ANALYSIS OF DEATHS BY CAUSE, ENTIRE PREMIUM PAID BY EMPLOYER, CALENDAR YEARS 1913–1920.

Shoes and Other Light Leather Goods (Industry Code No. 201).

Central Age.	Years Exposed.	Number of Deaths and Cases of Total and Permanent Disability.																	
		All Causes.	Ratio of Actual to Expected AM Ult. Table.	Typhoid.	Influenza.	Rheumatism.	Cancer and Other Malignant Tumors.	Tuberculosis.	Diabetes.	Diseases of Brain and Nervous System.	Diseases of Heart and Circulatory System.	Diseases of Respiratory System.	Cirrhosis of Liver.	Diseases of Digestive System.	Genito-Urinary and Prostate Diseases.	Accident.	Suicide.	Other Causes.	Total and Permanent Disability.
18....	9,626	27	75.8	2	5			3		2	3	4		3	1	3		1	
23....	9,271	48	123.4	1	6			21	1		3	10		2	2				2
28....	7,582	34	101.8		10			8	1	1		5		2	2			3	2
33....	6,230	28	97.6	1	8		1	7	1		2	3	1	2				2	
38....	5,172	20	74.3		2			4		1	6	1		2	2			1	1
43....	3,991	21	77.5		3		2	4			3	1		1	3	2		1	1
48....	2,855	27	98.5		1		2	3	1	3	3	4		2	5	1			2
53....	1,967	30	106.8		2		2	2		3	6	4		2	5	1	1	1	1
58....	1,410	28	91.2		1		2	4	2	5	3	4		1	2	2		1	1
63....	837	16			2		1			2	3	4		1	2			1	
68....	546	23					2	1		4	5	1	1		8			1	
73....	208	13			1		2			6	1	1		1	1				
78....	57	1													1				
83....	6	2									1				1				
88....	1																		
Total.	49,759	318	89.0	4	41		14	57	6	27	39	42	2	19	35	9	1	12	10

TABLE V (*Continued*).

EXPERIENCE BY ATTAINED AGE WITH ANALYSIS OF DEATHS BY CAUSE, ENTIRE PREMIUM PAID BY EMPLOYER, CALENDAR YEARS 1913–1920.

Furniture and Woodworking (Carriages and Musical Instruments) (Industry Code No. 222).

Central Age.	Years Exposed.	Number of Deaths and Cases of Total and Permanent Disability.																	
		All Causes.	Ratio of Actual to Expected AM Ult. Table.	Typhoid.	Influenza.	Rheumatism.	Cancer and Other Malignant Tumors.	Tuberculosis.	Diabetes.	Diseases of Brain and Nervous System.	Diseases of Heart and Circulatory System.	Diseases of Respiratory System.	Cirrhosis of Liver.	Diseases of Digestive System.	Genito-Urinary and Prostate Diseases.	Accident.	Suicide.	Other Causes.	Total and Permanent Disability.
18....	11,259	31	74.3	1	4			4		1	4	7				6		4	
23....	14,914	50	79.9		15			7		1	3	9		5	3	4		3	
28....	14,810	63	96.6	1	17		2	4	1	3	4	19	1	3	1	5		2	
33....	13,088	46	76.4	1	6			5	1	3	3	15		2	2	4		4	
38....	11,481	47	78.7	1	6		1	7		2	7	15		3	3	1		1	
43....	9,144	63	101.3		7		2	9	1	4	14	13		6	4	2		1	
48....	7,795	51	68.2		3		4	3		2	15	8		2	5	5	3	1	
53....	6,044	71	82.2	2	2		8	7		7	16	6	1	7	6	4	1	3	1
58....	4,854	81	76.6		4		14	2	1	8	16	13		3	7	3	2	3	5
63....	3,233	73	67.4		4		11	4	1	8	16	7	1	1	13	3	1	3	
68....	1,926	76	76.9		1		7	3	2	13	25	10	1	1	9	1		3	
73....	753	32					2	1		1	14	6		1	2	3		2	
78....	166	12			1					1	4	1		1	1			3	
83....	29	3								1	1	1							
88....	2																		
Total.	99,498	699	76.8	6	70		51	56	7	55	142	130	4	35	56	41	7	33	6

TABLE V (*Continued*).

EXPERIENCE BY ATTAINED AGE WITH ANALYSIS OF DEATHS BY CAUSE, ENTIRE PREMIUM PAID BY EMPLOYER, CALENDAR YEARS 1913–1920.

All Other Textiles (Wool, Cotton, Silk, etc.) (Industry Code No. 272).

Central Age.	Years Exposed.	Number of Deaths and Cases of Total and Permanent Disability.																	
		All Causes.	Ratio of Actual to Expected AM Ult. Table.	Typhoid.	Influenza.	Rheumatism.	Cancer and Other Malignant Tumors.	Tuberculosis.	Diabetes.	Diseases of Brain and Nervous System.	Diseases of Heart and Circulatory System.	Diseases of Respiratory System.	Cirrhosis of Liver.	Diseases of Digestive System.	Genito-Urinary and Prostate Diseases.	Accident.	Suicide.	Other Causes.	Total and Permanent Disability.
18....	72,695	255	94.8	18	61	1	2	36		12	13	44	1	22	10	23		9	3
23....	48,873	178	86.7	7	36		2	38		4	6	30		11	1	24	2	17	
28....	40,034	188	106.8	3	53		2	37	2	2	10	28		9	8	14	3	16	1
33....	33,185	184	120.5	4	37		5	27	1	13	14	31		10	9	17	4	10	2
38....	29,873	157	101.1	2	26	1	6	26	1	8	15	15	1	10	13	10	1	17	5
43....	23,521	137	85.7	3	14		8	10		11	13	24	1	12	14	11	3	11	2
48....	20,359	149	76.3	1	14		16	8	1	18	22	23		7	18	8	2	10	1
53....	14,611	173	82.8	1	15		15	6	1	19	27	25	1	9	18	11	2	13	10
58....	10,813	181	76.8		7		17	10		22	35	28	2	12	21	6	3	9	9
63....	6,787	154	67.7		9	1	21	3	4	20	38	17	1	7	13	10		10	
68....	3,479	142	79.6		2	1	10	8		20	39	14	2	6	19	11	2	8	
73....	1,297	68	67.1		1		5	2	3	10	23	8	1	3	7	3	1	1	
78....	343	14					1			4	5			1	3				
83....	54	4			1						1				1			1	
88....	11																		
Total.	305,935	1,984	85.6	39	276	4	110	211	13	163	261	287	10	119	155	148	23	132	33

TABLE V (*Continued*).

EXPERIENCE BY ATTAINED AGE WITH ANALYSIS OF DEATHS BY CAUSE, ENTIRE PREMIUM PAID BY EMPLOYER, CALENDAR YEARS 1913–1920.

Rubber (*Industry Code No. 293*).

Central Age.	Years Exposed.	Number of Deaths and Cases of Total and Permanent Disability.																	
		All Causes.	Ratio of Actual to Expected AM Ult. Table.	Typhoid.	Influenza.	Rheumatism.	Cancer and Other Malignant Tumors.	Tuberculosis.	Diabetes.	Diseases of Brain and Nervous System.	Diseases of Heart and Circulatory System.	Diseases of Respiratory System.	Cirrhosis of Liver.	Diseases of Digestive System.	Genito-Urinary and Prostate Diseases.	Accident.	Suicide.	Other Causes.	Total and Permanent Disability.
18....	8,494	30	95.5	1	7			1		2	2	10		2	1	3		1	
23....	17,932	60	79.7	2	8			8		5	3	10		3	2	13		6	
28....	16,150	64	90.0		13			11		8	2	15		3		6	2	4	
33....	11,910	58	105.8		10		1	10		3	2	12		5	2	10		2	1
38....	8,602	50	111.9		5		1	5		3	7	11	1	2	2	8	1	2	2
43....	5,708	45	116.0		5		4	6	1	6	4	7		2	1	2	2	4	1
48....	4,167	35	87.5		5		3	4		4	2	3		3	6	1		3	1
53....	2,540	38	104.7	1	2		3	2	1	7	3	10		1	2	4		2	
58....	1,465	19	59.6				1	1		4	5	2		1	3	1		1	
63....	725	12			1			2	1		1	1		2	2	1		1	
68....	336	10					2			2	4			1	1				
73....	123	8								2	3	1			1			1	
78....	24	4					1			1					1			1	
83....	5																		
88....	2	1								1									
Total.	78,183	434	90.5	4	56		16	50	3	48	38	82	1	25	24	49	5	28	5

TABLE V (*Continued*).

EXPERIENCE BY ATTAINED AGE WITH ANALYSIS OF DEATHS BY CAUSE, ENTIRE PREMIUM PAID BY EMPLOYER, CALENDAR YEARS 1913–1920.

Electric Light and Power (*Industry Code No. 342*).

Central Age.	Years Exposed.	Number of Deaths and Cases of Total and Permanent Disability.																	
		All Causes.	Ratio of Actual to Expected AM Ult. Table.	Typhoid.	Influenza.	Rheumatism.	Cancer and Other Malignant Tumors.	Tuberculosis.	Diabetes.	Diseases of Brain and Nervous System.	Diseases of Heart and Circulatory System.	Diseases of Respiratory System.	Cirrhosis of Liver.	Diseases of Digestive System.	Genito-Urinary and Prostate Diseases.	Accident.	Suicide.	Other Causes.	Total and Permanent Disability.
18....	2,195	9	111.1					1	1	1	1	1		1		3			
23....	4,412	30	162.2		2			2			1	2		3	1	19			
28....	5,747	41	162.1		8			5	1	1	1	5		1		15	1	3	
33....	5,145	36	151.9		9			6		1	4	2				11	2	1	
38....	4,026	35	167.5	1	2		2	1		1	3	3		3	2	14	3		
43....	2,812	23	120.4	1			1	2			5	5			2	6		1	
48....	1,845	20	113.0		2		1	1	1	1	3	4		1		4		2	
53....	1,300	17	91.4				2	1		3	4	2		2	2	1			
58....	728	18			1		2				3	2		3	2	4	1		
63....	408	10			1		1		1		3	3				1			
68....	205	5									1	1			1		1	1	
73....	76	6								1	3				1			1	
78....	18	1									1								
83....	4	1													1				
88....																			
Total.	28,921	252	125.6	2	25		9	19	4	9	33	30		14	12	78	8	9	

TABLE V (*Continued*).

EXPERIENCE BY ATTAINED AGE WITH ANALYSIS OF DEATHS BY CAUSE, ENTIRE PREMIUM PAID BY EMPLOYER, CALENDAR YEARS 1913–1920.

Retail Merchants and Dealers (Industry Code No. 371).

Central Age.	Years Exposed.	Number of Deaths and Cases of Total and Permanent Disability.																	
		All Causes.	Ratio of Actual to Expected AM Ult. Table.	Typhoid.	Influenza.	Rheumatism.	Cancer and Other Malignant Tumors.	Tuberculosis.	Diabetes.	Diseases of Brain and Nervous System.	Diseases of Heart and Circulatory System.	Diseases of Respiratory System.	Cirrhosis of Liver.	Diseases of Digestive System.	Genito-Urinary and Prostate Diseases.	Accident.	Suicide.	Other Causes.	Total and Permanent Disability.
18....	11,712	29	67.0	1	2		2	6		2	3	6		1	1	1		3	1
23....	12,931	40	73.7	2	4		1	10	1	2	4	6		3	2	3		1	1
28....	11,241	38	76.8		6			8		2	5	10		2	1	1	1	2	
33....	10,084	41	88.4		7		2	6		3	4	13		4	1		1		
38....	9,142	49	103.2	1	7		3	6	1	2	4	9		4	3		1	7	1
43....	7,242	44	89.4		1		3	2	1	3	10	5		5	8	5		1	
48....	5,416	52	100.0		1		6	2		7	10	8		4	7	3		2	2
53....	3,763	44	81.8		1		4	2		7	14	4		2	5	3	1		1
58....	2,622	57	99.7		1		5	4	2	5	20	5		2	6	3		4	
63....	1,573	43	81.6				8	2		5	10	8		3	4	1		2	
68....	806	30			1		4	2		5	9	2			6			1	
73....	329	24				1	4			2	6	5		1	4	1			
78....	92	5					1			1	2	1							
83....	19	4									1			1	1	1			
88....	5																		
93....		1													1				
Total.	76,977	501	85.1	4	31	1	43	50	5	46	102	82		32	50	22	4	23	6

Legal Notes.

BY

WENDELL M. STRONG.

(*Member of the New York Bar.*)

"Participating in Aeronautics": (Bew *vs.* Travelers Ins. Co., Court of Errors and Appeals of New Jersey, 112 Atl. Rep., 859.)

The insured was killed while flying as a passenger in an aeroplane; it was not certain whether he went as a guest or as one who was to pay for the trip. The policy in question provided that it should not "cover injuries fatal or non-fatal, sustained by the insured while participating in or in consequence of having participated in aeronautics."

The question was whether being a passenger in an aeroplane constituted "participating in aeronautics."

The court held that it did, quoting with approval from the opinion of the Supreme Court where a non-suit had been granted.

Extracts from the opinion are:

"There is nothing in the definition given, or in the common use of the term, to confine it to those who are active in the piloting of air vessels and to exclude those who are inactive users thereof. If it had been intended to confine the application of this provision to those who pilot or manage the physical operations of such vessels, it would probably have been expressed by using some such language as 'engaging in the piloting, management or operation of aeronautical vessels.'"

"I think that the plaintiff seeks to give too narrow a meaning to both words. 'Aeronautics' does not describe a business or occupation, like 'engineering' or 'railroading,' but an art which may be practiced for pleasure or profit, and is indulged in by all who ride, whether as pilots or passengers."

"If the question were respecting the scope of a provision that the policy did not apply to any one 'participating in tobogganing,' would it be asserted that the occupants of the sled who had no part in steering were not participating in tobogganing? If one rides in the rear seat of an automobile, is he not participating in automobiling? If one hires a motorboat and crew to take him for a

ride on a river, would it be said that he was not participating in boating? It seems clear that he would be."

"These illustrations show the speciousness of plaintiff's contention."

"I am of the opinion that one who is a passenger in an aeroplane partakes of the pleasure and benefits of the art or practice of sailing or floating in the air, and thereby participates in aeronautics."

PRESUMPTION OF DEATH FROM DISAPPEARANCE: (Steen *vs.* Modern Woodmen of America, Supreme Court of Illinois, 129 N. E. Rep. 546.) The regular presumption of death after unexplained absence of seven years is an anomaly in its application to life insurance. Yet the courts have, in a number of states, insisted on its making the policy payable, and even in some cases where it is contrary to the direct provisions of the policy or beneficial certificate.

In the present case a provision in the by-laws of the association that disappearance should not be regarded as evidence of death, and that it should not give any right to payment until the member's expectancy of life, according to the National Fraternal Congress Table of Mortality, had expired. This provision of the by-laws was upheld in the judgment.

The case is particularly interesting in the way the court in its opinion sets forth the true relation of the seven years' rule to life insurance.

The following are extracts from the opinion:

"This legal presumption of death from 7 years' unexplained absence arose by analogy under two early English statutes, the one exempting from the penalty of bigamy any person whose husband or wife should be continuously beyond the seas or should absent himself or herself for the space of 7 years together, and the other providing that persons in leases for lives who shall remain beyond the seas or absent themselves from the realms for more than 7 years shall, in the absence of proof to the contrary, be deemed naturally dead. That the rule in question is merely a rule of evidence is unquestioned. It was a rule born of necessity, to prevent the prosecution for bigamy of a deserted spouse, on the one hand, and to settle the property affairs of the absentee, on the other hand. It grew up in England at a time when travel was fraught with every danger known to man and when means of communication were primitive. Since this rule of law was established the social aspects of our civilization have been almost revolutionized. The improbability that accident, injury, sickness, or death could overtake a member of this Society without information of the fact reaching

his family and friends is very great. In case of need he scarcely could fail to find assistance among the million members of his own fraternity. Hospital, police, burial, and other records are collected and preserved in practically every State in this country and newspapers are published in every city and village, and, except for the reasons for which the law was originally established, there is now no sound reason for continuing the rule except that it has existed for so long a time that convenience makes it the best rule to follow where no other rule is established by statute or by agreement."

"We think any provision of a contract which tends to prevent unjust and fraudulent claims should be upheld. No insurance society could exist on reasonable rates if the face of the straight life policy were due to become due at the end of 7 years. As applied to life insurance, the common-law 7 years' absence rule is without reason and is based neither on fact nor experience. While the common-law rule will be enforced where the parties have not contracted otherwise, we think it not only reasonable, but entirely sound from a business standpoint, that the parties should contract to establish death in disappearance cases in accordance with tables scientifically made from experience."

Owner of Policy: (Hilton *vs.* New York Life Ins. Co., New York Supreme Court, 184 N. Y. Supp. 2.) The policy in question was payable to the insured's wife or, in the event of her death, to her children and did not contain any option to change the beneficiary. The company made a loan to the insured without the knowledge or consent of the beneficiary. The action was brought by the beneficiary to enjoin cancellation of the policy and determine the rights of the parties. The loan clause in the policy did not state who was entitled to obtain the loan. It directly followed the dividend clause, which clause gave the option of election of how the dividend should be applied to the "owner" of the policy, and it immediately preceded the cash surrender value clause which gave the right to the "insured" to surrender the policy for cash.

The court held as follows:

"Thus here Albert B. Hilton [the insured], being the owner and holder of this policy, could determine what application should be made of the dividends, could surrender the policy, and could determine upon the mode of settlement after his death. Although the provision of the policy in respect to loans does not state who had the right to use the policy as security for such a loan, or in other words to whom such loan was to be made, nevertheless it is clear that the loan was to be made to the owner or holder of the policy—that is, to the one to whom the policy was issued, or his assigns;

and this view is strengthened by the position of the clause in relation to the provisions in respect to dividends and surrender."

DELIVERY OF POLICY: (Commonwealth Life Ins. Co. *vs.* McGuire, Court of Appeals of Kentucky, 226 S. W. Rep. 402.) The applicant at the time of the application for a $500 policy made the small deposit of $1.00 with the agent. The policy was issued and was received by the General Agent at Owensboro about August 19th or 20th. One of the agents of the Owensboro office called at the applicant's home on the morning of August 20th and delivered another policy to the applicant's wife, but told her he forgot to bring the policy in question, but that he would go back to the office and get the policy. She told him to do this and told him that she had the money for the balance of the premium. The agent, however, did not return that day. The applicant was injured the afternoon of the 21st and died a day later, the policy not having been actually delivered at the time of death.

The application and the receipt for the $1.00 each specified that the company was not to incur liability on account of the deposit "unless and until a policy is issued upon said application and unless at the date and delivery of said policy the life proposed is alive and in sound health." The court held that "the contract therefore was a completed one, and there remained nothing to be done except the actual delivery of the policy, if that were necessary, and the collection of the balance of the premium," and affirmed the judgment of the trial court against the company.

An extract from the opinion is:

"McGuire undoubtedly was entitled to the possession of the policy which had been issued upon his life and in which his wife was named as beneficiary and on which a part of the premium had been paid and which he had demanded, and offered the payment of the balance of the premium. The agent had no right to retain possession against him; in fact, the agent was holding the contract for the use and benefit of McGuire."

DELIVERY OF POLICY: (House *vs.* Bankers Reserve Life Co. of Omaha, Nebraska, Supreme Court of So. Dakota, 180 N. W. Rep. 69.) The application provided in very specific language that the policy should not go into force unless delivered to the applicant while alive and in good health. The applicant paid the premium at the time of making application and in due course the application was approved at the home office and a policy written and mailed to

the applicant. Meanwhile the applicant had died of influenza, so that the condition of delivery was not fulfilled.

The court held as follows:

"For the reasons stated in the decisions cited and quoted, we are of the opinion that at the time of the death of the applicant, John A. House, the provisions of the said application, whereby he agreed that under no circumstances should said insurance so applied for by him be in effect until a delivery of the policy to him during his lifetime while he was in good health, was in full force and effect, the fulfillment of which agreement was a condition precedent to the completion of the contract of insurance thereby applied for by him; that the policy issued after his death was wholly ineffectual either as a completed contract of insurance or as a waiver of said stipulation contained in the application; and that, by reason thereof, no binding contract of insurance was in existence between appellant and said John A. House at the time of his death."

Delivery of Policy; Power of Agent: (Kansas City Life Ins. Co. *vs.* Ridout, Supreme Court of Arkansas, 228 S. W. Rep. 55.) The policy contained a provision that it should not take effect "unless the applicant is in good health at the time of its delivery." The insured was ill at the time the policy was delivered and there was conflicting testimony as to whether the agent was informed of such illness or not when he delivered the policy. The verdict of the jury, however, involved its deciding that the agent was informed of such illness. Thus the question before the Supreme Court was whether the act of the agent in delivering the policy bound the company. The court held that it did and affirmed the judgment against the company.

Holding of Remittance for Overdue Premium "in Suspense": (Nelson *vs.* Mutual Life Ins. Co. of New York, Supreme Court of Montana, 190 Pac. Rep. 927.) After the policy had lapsed the manager for the territory wrote the insured a letter calling attention to the lapse and urging him to take steps to restore. The insured then forwarded check for the amount of the premium; this was placed "in suspense" by the company and a letter written to insured informing him of this fact and explaining the necessity of a satisfactory certificate of health. No attention was paid to this letter. A few weeks later the company again wrote, calling attention to the necessity for a certificate of health and stating that if it were not received by a certain date the remittance

received would be refunded. A few days after the second letter the insured died. Claim was made under the policy on the ground that the receipt and retention of the money was a waiver of the forfeiture.

The court held:

"Our opinion is that the policy had lapsed, that the letters addressed to the insured clearly negatived a waiver of the forfeiture committed by the insured, and that the judgment and order refusing plaintiff a new trial should be and are affirmed."

An extract from the opinion is:

"To work a restoration of the policy two things were necessary under its provisions: proof of insurability satisfactory to the company, and a tender of the overdue premium and interest from the time of default. Assuming that by retaining the check the company waived the interest on the overdue premium, evidence that it did not waive production of the health certificate, as the policy required, is furnished in the three letters addressed to the insured, advising him that the policy had lapsed and that the health certificate was a condition precedent to the restoration of his rights in the premises."

It is believed that this is the correct doctrine, but see *T. A. S. A.*, XXI, 223.

Cash Loan on Missouri Policy: (Liebing *vs.* Mutual Life Ins. Co. of New York, Supreme Court of Missouri, 226 S. W. Rep. 897.) This case involved the Missouri Non-Forfeiture law and came up to the Supreme Court on appeal for the third time.

Under the Missouri non-forfeiture law in force when the policy was issued a cash loan could not be deducted in determining the amount applicable to the purchase of extended insurance on lapse, and if this law applied the policy was in force under extended insurance when the insured died. The question was therefore whether the loan agreement was a New York or Missouri contract. When the case came up on appeal the second time, the case of New York Life Insurance Company *vs.* Dodge (*T. A. S. A.*, XIX, 91) had just been decided in the United States Supreme Court, and in conformity with that decision the Missouri Court decided in the Liebing case that the loan agreement was a New York contract and reversed a judgment for the plaintiff (*T. A. S. A.*, XX, 174).

On a retrial of the case judgment was again rendered for the plaintiff and the company appealed. The Missouri Supreme Court by a division of four to three upheld the decision of the lower court.

The majority opinion held that the court in its opinion on the previous appeal had erred in holding that the Dodge case controlled the present one. In endeavoring to distinguish the two cases the court quoted the provisions regarding loans in the two policies and drew the conclusion that in the Dodge case the company did not absolutely agree to loan on the policy, thus making it optional with the company to make the loan, whereas in the Liebing case there was an absolute obligation on the company under the policy to make the loan. Hence, the court held, the loan agreement in the Liebing case was not an independent contract, but was subsidiary to the policy, and therefore was controlled by the same statute that controlled the policy itself, viz., the Missouri non-forfeiture law.

While this is the decision of the court, a careful review of all the facts, including the policy provisions, does not seem to bear out the conclusions of the court. There was a strong dissenting opinion. The company has appealed the case to the United States Supreme Court and the final decision will be awaited with interest.

"Engaged" in Military or Naval Service: (Bradshaw *vs.* Farmers & Bankers Life Ins. Co., Supreme Court of Kansas, 193 Pac. Rep. 332.) The policy provided for the reduction of the liability of the company to the premiums paid if the insured should "engage" in military or naval service, and should die while in such service without having secured a permit for such service and paid the extra premium required. The insured was drafted and some months after being inducted into service died of influenza at a military camp. While in service he had served as a blacksmith, and the latter part of the time had not been required to drill, but wore the uniform of a soldier and was under military supervision.

The chief question was whether the insured was "engaged" in military service. The court held that he was.

An extract from the opinion is:

"We are unable to agree with those decisions holding that the expression 'engaged in military service' means the performance of functions in actual war or in resisting the hostile action of the enemy. As used in the policy in question, the term means no more than that the insured was in the military service. Status and not causation is the ground for the limitation, and it is plainly provided that anyone engaged in military service may, by obtaining consent of the insurer and paying added premiums, keep alive the whole insurance provided by the policy."

FACILITY OF PAYMENT CLAUSE: (Slingerland *vs.* Prudential Ins. Co., Court of Errors and Appeals of New Jersey, 110 Atl. Rep. 913.) The policy contained the usual "facility of payment" clause. The executor of the insured demanded payment of the amount due on the policy. A day or two after this demand reached the company, but before it reached the department making payment, the company made payment to a daughter. The executor brought suit and the company relied, as a defense from liability, on the "facility of payment" clause. The plaintiff claimed that the "discretion conferred upon the insurer under the above clause must be exercised before payment is demanded by the representative of the deceased." The court held, however, that the executor's right to thus limit the power of selection by the insurer was not in the contract and that this was a complete answer to the claim. The judgment of the lower court in favor of the defendant was affirmed.

EXCLUSION FROM COVERAGE OF DEATH DUE TO WAR: (Vanderbilt *vs.* Travelers Ins. Co., New York Supreme Court, 184 N. Y. Supp. 54.) The life policy contained the provision: "Nor shall this insurance cover . . . death . . . resulting, directly or indirectly, wholly or partly, from . . . war or riot." The insured was drowned in the sinking of the *Lusitania.*

The court held that:

"The concessions of the parties that the *Lusitania* was sunk in accordance with instructions of a sovereign government, by the act of a vessel commanded by a commissioned officer of that sovereign government, being then operated by that said officer and its crew, all of whom were part of the naval forces of the said sovereign government, and that war was then being waged by and between Great Britain, the sovereign controlling the *Lusitania,* and Germany, the sovereign controlling the submarine vessel, control the conclusion which must be reached that the casualty resulted from war and that the consequences of the casualty come within the excepted portions of the policy."

Judgment was given for the company.

CHANGE OF BENEFICIARY: (Lovinger *vs.* Garvan, Alien Property Custodian, District Court S. D., New York, 270 Fed. Rep. 298.) The insured was a working woman and the plaintiff, without pay, did many acts of kindness for the insured and took care of the

insured in the insured's last illness. The insured promised to change the beneficiary so as to make the plaintiff beneficiary under the policy in question and had requested the agent of the company to take steps to make the change. He, however, delayed the matter by suggesting that the insured wait until she recovered. The insured further, on the day before her death, executed a document by which she bequeathed the policy and what money she had in the bank to the plaintiff.

The question before the court was whether the beneficiary had been changed. The court held that, where there was no valid contract made by the insured during her lifetime, nothing short of an actual exercise of the power of the insured according to the conditions of the contract would effect the change, but that "if the new beneficiary is a promisee for consideration of the person having the power, he has a right to compel the specific performance of the power, which is not determined by the death of the promisor."

The court further held that the facts of this case were sufficient to show a promise based on consideration of the plaintiff's taking care of the insured and that, in consequence, effect should be given to the agreement to change the beneficiary, the bequeathing of the policy to be regarded as simply having a probative value.

This case probably goes farther than any other in giving effect to the wishes of the insured to change the beneficiary when neither the change nor the ordinary acts necessary thereto were performed by the insured during her lifetime.

Premium Tax: (People ex rel. Metropolitan Life Ins. Co. *vs.* Knapp et al., State Tax Commission, Supreme Court of New York, Appellate Division, 184 N. Y. Supp. 345.) The question was whether under the statute providing for a tax on "premiums" the consideration paid to the company for annuities was to be included in determining the amount of the tax. The court held that it was not to be included.

The case has been appealed.

Bankruptcy; Right of Trustee to Surrender Value: (In re Greenberg, U. S. Circuit Court of Appeals, Second Circuit, 271 Fed. Rep. 258.) It has been settled that where a beneficiary option exists without limitation the trustee in bankruptcy acquires the right to the surrender value of the policy. In the present case

there is a peculiarity in the policy, which is that the change could be made only "with the consent of the company." The court stated that the attitude of the company was that of refusing to change, and the question was whether the condition requiring the consent of the company could be enforced to prevent the trustee from acquiring the surrender value. It was held that it could not.

FRAUD; SETTLEMENT OF POLICY: (American Central Life Ins. Co. *vs.* Bott, Appellate Court of Indiana, Division No. 2, 130 N. E. Rep. 432.) After the death of the insured the company issued a check to the beneficiary. Before the check was cashed the company discovered circumstances leading it to believe there was fraud in the inception of the policy, and stopped payment of the check. Suit was brought and to the defense of fraud in obtaining the policy the plaintiff demurred and the demurrer was upheld. The court held that the matter was concluded by the issuance of the check, since the beneficiary was not claimed to have any part in the fraud.

MATERIALITY: (Livingston *vs.* Union Central Life Ins. Co., Supreme Court of South Carolina, 104 S. E. Rep. 538.) The insured in his application stated that he had not consulted a physician within five years, whereas he had consulted a physician two years before.

The court's opinion as to the effect of this misstatement was as follows:

"Whether the answer under consideration was 'material to the risk' is a mixed question of law and fact.

"The only testimony thereabout is that of the medical director, Dr. Muhlberg. He testified:

"'If any applicant states that he has consulted a physician within five years, our practice is to find out why he consulted a physician.'

"That is all.

"The defendant has drawn the sword, and it must abide the practice of such. It has appealed to the letter of the contract; it must abide the letter of the testimony. It was bound to offer testimony tending to prove that in the instant case, had it known of the consultation, it would have 'found out' the reason of the consultation; it did not do that. The witness did not say how he would 'find out,' and he did not say that he would have rejected Dr. Gibbes' diagnoses and made one for himself; and if he could say with any certainty what he 'would have done,' it would be

hazardous to insurance contracts to make them depend upon what a person might have done under hypothetical circumstances. And at most, the issue of what the company 'would have done' is one ordinarily for a jury, and not for a court.

"But we are not satisfied that there is no testimony tending reasonably to prove that the instant answer was material to the risk, and that a verdict ought to have been directed for the plaintiff, and so much must yet be done."

The doctrine here set forth that, as a matter of law, the misstatement was not material is not in accord with that obtaining in other jurisdictions.

MATERIALITY: (Selick *vs.* New York Life Ins. Co., Supreme Court of Ontario, Appellate Division, 48 Ontario Law Reports, 416.) In the application the insured in answer to the question whether he had consulted a physician within five years answered "No," whereas he had so consulted a physician. The jury found that this false answer was not material. The court quoted with approval the following test of materiality:

"The principle is that the underwriter must have the opportunity of deciding for himself whether the knowledge of the material fact shall in fact influence him or not, and I am clear that the underwriter in question was entitled to have the fact disclosed to him."

It held that the finding of the jury that the false answers were not material must be set aside.

MISSTATEMENT IN APPLICATION: (Security Life Ins. Co. of America *vs.* Black's Adm'r, Court of Appeals of Kentucky, 226 S. W. Rep. 355.) There was strong testimony tending to show that the statements of the insured in the application both in reference to personal and to family history were false.

Kentucky had a statute providing: "nor shall any misrepresentation unless material or fraudulent prevent a recovery on the policy." The lower court in charging the jury stated: "Now, if you believe from the evidence stated that all or any one of said answers were substantially untrue to the best of the knowledge and belief of the applicant, Frank Black, Jr., . . . then you will find for the defendant."

The jury brought a verdict for the plaintiff. The Court of Appeals had the question before it whether the part of this charge involving the knowledge and belief of the insured was error. It

held that it was error and reversed the judgment and remanded the cause.

The following is an extract from the opinion:

"The statute has also dispensed with any misrepresentation as a defense to a recovery upon the policy, unless it is a misrepresentation concerning a matter which is material to the risk assumed by the insurance company in entering into the contract or is a misrepresentation made fraudulently. It follows that a misrepresentation which is either material or fraudulent will void the policy. The statute does not ordain that the misrepresentation must be both material and fraudulent to be effective as a defense to recovery upon the policy. Hence it follows that, if a material misrepresentation is made, though innocently, the good faith and honest belief of the insured in its truth will not protect the policy contract from defeat."

Period of Contestability: (Hardy *vs.* Phoenix Mutual Life Ins. Co., Supreme Court of North Carolina, 104 S. E. Rep. 166.) The point that is of interest is the interpretation given to the provision of the policy that it should be incontestable after one year from its date. The insured had died within the year, but the company brought no action within that period to cancel the policy.

The court held that the lapse of one year's time, even though the insured had died before the end of the year, made the policy incontestable. (See *T. A. S. A.*, XIX, 104.)

Interpretation of Statute: (Ross *vs.* Capitol Life Ins. Co., Kansas City Court of Appeals, 228 S. W. Rep. 889.) The Missouri statute provided for extended insurance on lapse unless "the policy shall contain a provision . . . for the unconditional commutation of the policy for nonforfeitable paid up insurance." The policy provided:

"If this policy shall lapse after being in force three full years, it will automatically become a paid-up policy for such amount as is hereinafter set forth in the Table of Surrender and Loan Values herein."

The insured died not long after lapse and the question was whether the above-quoted provision of the policy complied with the above-quoted requirement of the statute in providing for nonforfeitable paid-up insurance.

The court held that a provision for paid-up insurance was not the same as for non-forfeitable paid-up insurance, and that hence

extended insurance instead of paid-up insurance for a smaller amount was in force at the insured's death. It instanced that there might be conditions under paid-up insurance. It did not, however, refer to any condition or provision of the policy contract before it under which the insurance could be forfeited, and it is difficult to say in what way the usual paid-up insurance issued on lapse could become forfeitable. Hence it would seem that the clause in the policy complied with the statute in question notwithstanding the decision of the court to the contrary.

Power of Agent to Bind Company: (Combs, Adm'x, *vs.* Jefferson Standard Life Ins. Co., Supreme Court of North Carolina, 106 S. E. Rep. 826.) The insured died over a year after policy had lapsed for non-payment of premium. There was testimony that the circumstances of the non-payment of premium were as follows: The agent called upon the insured about the time the premium was due, or shortly after, and within the days of grace, and started to urge the insured to pay the premium and interest on a loan. Upon learning, however, that the insured had tuberculosis he told the insured that the policy had become void and the company would accept no more premiums. The matter was taken up before the insured's death by the insured and suit brought for reinstatement.

The court held that the lapse of the policy, having been procured by the false representations of the agent of the company, the policy was in force at the time of death of the insured.

Assignment: (Thompson's Ex'x *vs.* Thompson, Court of Appeals of Kentucky, 226 So. Rep. 350.) The policies in question were payable to the insured's wife, or, in case she predeceased him, to his executors, administrators or assigns. The insured during the lifetime of his wife wrote an assignment on the policies, assigning each of them to his children in case of his wife's prior death. The policies required the assent of the company to any assignment. The insured forwarded the policies, after writing the assignments thereon, to the agents of the company, who returned them, stating that the assignments should be on the regular blanks. Nothing more was done at that time, but after the death of the wife the insured sent the policies to the company, who put an endorsement on that the wife being dead the policies were payable to the insured

or his executors, administrators or assigns. Upon the death of the insured both the executrix and the children claimed.

The court held that the assignment being only of the interest that the insured had in the policy and not in conflict with the wife's vested interest, was valid, and that consequently the children were entitled to the proceeds.

Fraternal Order; Change of By-Laws: (Sawyer *vs.* Sovereign Camp, W. O. W., Supreme Court of Nebraska, 181 N. W. Rep. 191.) The insured became a member of the association while a laborer, paying his dues on that basis. The insurance was conditioned upon the members complying with existing and subsequently enacted by-laws. A by-law enacted after the insured became a member required a notice to be given in case of change to the hazardous occupation of switchman and also an extra assessment to be paid. The insured did change to this occupation, but did not give notice or pay the extra, but paid the assessments at the old rates. He was killed while in the service of the railroad.

The association denied liability because of the violation of the by-laws. The beneficiary brought suit, basing her claim upon the contention that the by-law was void "as being unreasonable and as depriving her of vested rights." The court held that the change in the by-laws was reasonable, and that the insured not having complied with it the insurance was, by the terms of the contract, forfeited.

Effect of New By-law of Fraternal Association: (Roblin *vs.* Supreme Tent of Knights of Maccabees of the World, Supreme Court of Pennsylvania, 112 Atl. Rep. 70.) The insured in this case disappeared. Some two years after his disappearance a by-law was passed which prevented absence unheard for seven years from being used as evidence of death for the sake of making the insurance payable. The court held that a by-law must be reasonable to be binding on existing policies, and that the one in this case was not, because substantial rights which rested upon the contract would be abrogated by it.

Dependency: (Sovereign Camp, W. O. W., *vs.* Hoehn, Supreme Court of Alabama, 85 So. Rep. 696.) Under the terms of the constitution of the order issuing the benefit certificate in question

only certain relatives or "persons dependent upon the member" could be beneficiary. The plaintiff in this case was named beneficiary, and as she was not a relative, could only take if she was a dependent.

The beneficiary was a trained nurse, but she left employment and went to the home of the insured to nurse his wife in her last illness, which lasted for some months. It was testified that the insured said upon the arrival of the beneficiary that if she would look after his wife she, the beneficiary, would never want as long as he lived; that for a month after the wife's death the beneficiary remained at the house of the insured and looked after him; that during the following month he had broken up housekeeping, and that the beneficiary went to the place where he boarded to mend his clothes and put things in order, but he did not furnish her any board, clothing or money for support, and that she had employment part of the time and earned some money. At the end of this month the insured died.

The court held that there was nothing in these facts to justify a reversal of the judgment in favor of the plaintiff, which judgment must necessarily have involved finding that she was a dependent.

Correction of Age Where Application Not Attached: (Metropolitan Life Ins. Co. *vs.* Trilling, Supreme Court of New York, Appellate Division, 184 N. Y. Supp. 898.) The policy was a New York policy. The New York statute provided that nothing should be incorporated in the contract by reference to the application unless it was endorsed on or attached to the policy when issued. No copy of the application was endorsed on or attached to the policy. Some years after the policy was issued it was ascertained that the insured was two years older than stated in the application. The policy contract provided in regard to misstatement of age: "If the age of the insured has been misstated, the amount payable thereunder shall be such as the premium paid would have purchased at the correct age." The company claimed the right to reform the contract in accordance with this provision. This was contested on the ground that the age was stated in the application and, because no copy of the application was attached, the statement could not be made use of.

The court held that as the policy itself stated the age of the insured on its face, this answered the requirements of the law, and that the company was entitled to the reformation of the policy.

Murder of Insured by Beneficiary: (Spicer *vs.* New York Life Ins. Co., U. S. Circuit Court of Appeals, 268 Fed. Rep. 500.) Husband and wife held a joint life policy payable to the survivor on the death of either. The husband murdered the wife. The question before the court was whether the policy was payable to the husband or, if not payable to him, was payable to anyone. The District Court held that the husband was not entitled to receive the proceeds, being barred by the murder, and that there was nothing payable to anyone. (*T. A. S. A.*, XXI, 494.)

The Circuit Court of Appeals in affirming held that the insurer in such a policy was not liable in any contingency to pay anything to the personal representative of that one of the two insured whose death was caused during the continuance of the policy and

"that law does not give to the making of such a contract the effect of imposing on a party to it a liability not shown by the written instrument evidencing it to have been incurred by such party."

Effect of Failure to File Policy Where Required: (Graf *vs.* Employees' Liability Ins. Co., Ltd., Supreme Court of Iowa, 180 N. W. Rep. 297.) The policy in question was an accident policy and it was claimed that false statements were made in the application, the statements in the application being made warranties. The plaintiff contended that the company was estopped from pleading such warranties because of the failure of the company to file the policy with the State Insurance Department or have the policy approved by it as required by statute.

The court held that while the failure to file in conformity with the statute rendered the company subject to the imposition of a fine, it did not destroy the terms of the contract with the insured, and that the insured could not "insist on the portion of the policy favorable to his contention and repudiate the remainder."

Surgical Operation: (Aetna Life Ins. Co. *vs.* Brand, U. S. Circuit Court of Appeals, Second Circuit, 265 Fed. Rep. 6.) The policy involved was a policy of accident insurance insuring against bodily injury effected solely through external, violent and accidental means. While the insured was being operated on the physician's needle pierced an artery which was not in the place usual for that artery. The result was that after the operation one of the insured's legs became gangrened and finally had to be amputated.

The court held that although the injury took place in the course of an operation the injury itself was accidental and the loss was caused by external, violent and accidental means, so as to make the company liable.

It is hard to reconcile this case with others that distinguish between accidental means and accidental results. In this case the surgeon placed the needle in exactly the place it was intended to go, so that it was only the result which was accidental.

ACCIDENTAL MEANS: (State Life Ins. Co. *vs.* Allison, Circuit Court of Appeals, Fifth Circuit, 269 Fed. Rep. 93.) The insured was killed by a fragment of a shell while engaged in one of the battles in France. The policy of insurance provided for "double indemnity" in case the death of the insured resulted from "external, violent, and accidental means, etc.," but did not except military service as one of the risks not assumed under the "double indemnity" provision. The question was whether the death through being struck by a shell which had been shot by the enemy for the purpose of injuring or killing those opposed was death by "accidental means." The court held that it was.

"Though the means whereby a personal injury or death is caused were put into operation with the design or intention of killing or injuring one or more persons, if chance determines what particular person or persons are injured or killed in consequence of the use of those means, as to a person so injured or killed, without his fault, consent, or co-operation, such means are to be regarded as accidental within the meaning of the provision in question."

(Martin *vs.* People's Life Ins. Co. of Jonesboro, Supreme Court of Arkansas, 222 S. W. Rep. 389.) The facts are exactly parallel to those of the above case, except that it was a case of indemnity for disability due to injury instead of a death benefit. The court, however, held that the injury was not accidental and affirmed a directed verdict in favor of the defendant.

EXTERNAL, VIOLENT AND ACCIDENTAL MEANS: (Bell *vs.* State Life Ins. Co. of Indianapolis, Supreme Court of Georgia, 105 S. E. Rep. 846.) The suit was for "double indemnity," payable if the insured died from "bodily injury sustained and effected directly through external violent and accidental means, exclusively and independently of all other causes." The insured, a physician, acci-

dentally received a scratch on his right ear, breaking his skin. This became infected while attending an erysipelas patient. As a result he died.

The lower court had held, as a matter of law, that the company was not liable, it appearing from the evidence that the scratch had not occurred during the time of one of the insured's visits to the patient, but occurred at some other time and became infected during such visit. Consequently the lower court held that there was nothing to go to the jury. (*T. A. S. A.*, XXI, 231.)

The Supreme Court held, however, that even in this case the question of the company's liability should go to the jury. An extract from the opinion is:

"It is said, however, that if the infection occurred as a consequence of the voluntary act of the assured in thereafter subjecting the wound or abrasion to such a serious and dangerous exposure as a visit to a patient suffering from erysipelas, a contagious and infectious disease, the defendant would not be liable. We think this also would be a question to be determined by the jury."

ACCIDENT POLICY; INSURED KILLED BY ANOTHER: (Berrymen *vs.* Southern Surety Co., Supreme Court of Missouri, 227 S. W. Rep. 96.) The policy was an accident policy providing against death resulting from "external, violent and accidental means." The insured was shot by another in a quarrel.

The court held that if the insured assaulted the other, knowing that the other had a deadly weapon, then he must be assumed to have known the probable consequence of his act was that he would be killed, and in such case his death would not be accidental, but that if he was killed by the other without having indicated an intention of assaulting the other, knowing the other was armed, then the killing was accidental to the insured and the policy was payable.

The Supreme Court affirmed the judgment for the plaintiff except that it held that the company was justified from the circumstances in obtaining a legal decision on the claim, and that the question of vexatious litigation should not have been submitted to the jury, and that the part of the judgment allowed as penalties for such litigation should be remitted.

DISEASE A CONTRIBUTING CAUSE OF DEATH UNDER ACCIDENT POLICY: (Campbell *vs.* Aetna Life Ins. Co., Supreme Court of

Missouri, 222 S. W. Rep. 778.) The policy involved in this case was a California contract and the insured a California resident, and the question was decided according to the California rather than the Missouri law, as the court made very clear in the opinion. The policy was the usual accident policy providing

"against loss, as herein defined, resulting directly and independently of all other causes from bodily injuries effected solely through external, violent, and accidental means, suicide (sane or insane) not included."

The insured strained himself in a stroke in playing golf and died about three weeks later. It was shown on autopsy that there was a tumor of the liver and that this had been injured, and that this injury presumably caused the death.

The court held that it was evident that the death occurred from the injury to the cancerous growth, which injury could not have occurred had there been no such growth, and that consequently the loss did not result from bodily injury independently of all other causes.

The judgment of the lower court in favor of the company was affirmed.

INTERPRETATION OF "SEVERANCE OF FOOT AT OR ABOVE THE ANKLE": (Jones *vs.* Continental Casualty Co., Supreme Court of Iowa, 179 N. W. Rep. 203.) The policy, an accident policy, provided for payment of $1,000 for the "loss of either foot," and a later provision in the policy provided that the word "loss" above used with reference to hand or foot means complete severance at or above the wrist or ankle.

The insured's foot was crushed and part of it amputated, one half of the arch being removed; the heel and part of the foot, however, remained.

The court held that this constituted a severance at or above the ankle, or "at least it was a question for the jury." In this it reversed the lower court, which had directed a verdict for the defendant.

DAMAGES FOR "VEXATIOUS REFUSAL" TO PAY: (Merkel vs. Railway Mail Ass'n, St. Louis Court of Appeals, 226 S. W. Rep. 299.) The policy was an accident policy and the cause of death given by

the attending physician in the death certificate was appendicitis, a cause of death which would not have rendered the company liable. In the trial, however, it appeared that the insured's death was due to accidental injuries. Besides the amount of the policy the jury awarded damages for vexatious refusal to pay.

The court held that in view of the facts of the case, and particularly the cause of death as given in the death certificate by the attending physician, the company had a right to defend such action, and the question of vexatious refusal should not have been submitted to the jury, the court indicating that it could only be submitted to the jury when there was some substantial evidence tending to show that such refusal was wilful and without reasonable cause.

Abstract of the Discussion of Papers Read at the Previous Meeting.

ACTUAL DEATHS IN THE MUTUAL LIFE INSURANCE COMPANY OF NEW YORK COMPARED WITH THE EXPECTED BY THREE STANDARDS—

WILLIAM A. HUTCHESON.

VOL. XXI, PAGE 378.

(For other discussions, see Vol. XXI, page 385.)

MR. W. P. BARBER, JR.:

Connecticut Mutual Mortality Experience, 1907–1918. The Connecticut Mutual has recently compiled its mortality experience for the eleven years 1907 to 1918. As the experience corresponds with that presented by Mr. Hutcheson for the Mutual Life Insurance Company of New York at our October, 1920, meeting, the tables offered in this paper are in a form which will admit of a ready comparison with the tables presented by Mr. Hutcheson.

The experience submitted covers all plans of insurance except those for substandard risks. During the period covered by the investigation the Connecticut Mutual was writing business in all states of the United States but the following: Alabama, Arkansas, Arizona, Florida, Idaho, Louisiana, Mississippi, Montana, Nevada, New Mexico, N. Dakota, S. Carolina, S. Dakota, Tennessee, Texas, Wisconsin and Wyoming. A small amount of business written in Utah is included. This group eliminates all of the so-called "Southern States" with the exception of Georgia, where the Connecticut Mutual obtains its business chiefly from inland counties. The volume of the Georgia business included is, however, relatively small.

The present experience covers 84,444 policies for $202,335,000 of insurance, about one-sixth of the volume covered by the Mutual Life.

Table I, Summary, seems to bear out the theory offered by Mr. Hutcheson, that a constant percentage of the American Men Table may prove a good guide of the mortality to be experienced. Analyzing the source of the figures, in the last section of Tables II and III, "Summary by Policy Years," it will be noticed that the variations from the average are more marked than in the case of the Mutual

Life. This is only natural from the smaller volume of insurance. In order that a detailed study of this factor may be more readily made, Table IV has been prepared, showing the percentages of actual to expected deaths by the American Men Table from the experience of both companies. The fact that the Connecticut Mutual experience contains little business from the Southern States probably has its bearing on the lower ratios obtained.

In the Connecticut Mutual experience the ratios of actual to expected mortality by the American Men Table indicate for both Policies and Amounts that the most favorable mortality was obtained in the group of ages where the bulk of the business was written, ages 30–39, with a distinct tendency for the ratios to increase from this point in the direction of both higher and lower ages. In fact, a plot of the ratios from the majority of the tables gives a distinctly bowl-shaped curve. This tendency does not appear in the Mutual Life experience to any appreciable extent although the mortality of the Mutual Life below age at issue 20 also appears relatively unfavorable.

Some interesting details of distribution of business and mortality in different age groups may be obtained by comparing the Tables from Mr. Hutcheson's article on pages 380–384 of *Transactions*, Vol. XXI, with Tables I to III of this report.

TABLE I. Summary.

All Ages at Issue.

Ratio of Actual to Expected Deaths.

	By Policies.			By Amounts Insured.		
Policy Year.	M.-A.	AM	Amer.	M.-A.	AM	Amer.
1.....	59.7%	71.3%	27.6%	58.3%	69.9%	28.0%
1–5.....	60.9	69.1	35.5	64.3	72.3	39.0
6–11.....	70.9	69.2	48.8	72.7	69.7	52.6
1–11.....	63.6%	69.1%	38.7%	66.8%	71.5%	42.4%

TABLE II. By Policies.

Issues of 1907 to 1917, Exposed to the Anniversaries in 1918.

Ratio of Actual to Expected Deaths by Three Tables.

Ages at Issue.	Exposures.	Deaths.	M.-A. Table (Select).		Amer. Men Table (Select).		Amer. Table.	
			Expected.	Percent.	Expected.	Percent.	Expected.	Percent.
Policy Year One.								
15–19	3,660	10	11.346	88.1	9.568	104.5	28.294	35.3
20–29	36,234	76	122.991	61.8	105.028	72.4	291.964	26.0
30–39	26,582	46	103.034	44.6	84.201	54.6	236.014	19.5
40–49	13,560	47	73.102	64.3	62.146	75.6	147.564	31.9
50–59	3,940	29	42.728	67.9	34.749	83.5	66.540	43.6
60–69	468	9	10.493	85.8	8.827	102.0	15.045	59.8
Total	84,444	217	363.694	59.7	304.519	71.3	785.421	27.6
Policy Years One to Five.								
15–19	11,245	44	45.306	97.1	37.398	117.7	87.621	50.2
20–29	116,328	304	497.060	61.2	424.812	71.6	949.195	32.0
30–39	89,745	226	432.051	52.3	375.857	60.1	817.657	27.6
40–49	47,286	216	345.593	62.5	317.127	68.1	544.561	39.7
50–59	13,988	128	208.682	61.3	191.379	66.9	263.245	48.6
60–69	1,799	50	60.862	82.2	54.278	92.1	68.186	73.3
Total	280,391	968	1,589.554	60.9	1,400.851	69.1	2,730.465	35.5

TABLE II. By Policies (*Continued*).

Issues of 1907 to 1917, Exposed to the Anniversaries in 1918.

Ratio of Actual to Expected Deaths by Three Tables.

Ages at Issue.	Exposures.	Deaths.	M.-A. Table (Select).		Amer. Men Table (Select).		Amer. Table.	
			Expected.	Percent.	Expected.	Percent.	Expected.	Percent.
Policy Years Six to Eleven.								
15–19	2,688	7	12.665	55.3	11.440	61.2	21.603	32.4
20–29	29,364	114	144.917	78.7	133.540	85.4	251.219	45.4
30–39	25,740	81	156.516	51.8	160.501	50.5	258.065	31.4
40–49	13,324	111	146.418	75.8	159.728	69.5	188.973	58.7
50–59	4,101	82	96.617	84.9	105.879	77.4	106.927	76.7
60–69	669	27	38.351	70.4	38.644	69.9	38.847	69.5
Total	75,886	422	595.484	70.9	609.732	69.2	865.634	48.8
Policy Years One to Eleven.								
15–19	13,933	51	57.971	88.0	48.838	104.4	109.224	46.7
20–29	145,692	418	641.977	65.1	558.352	74.9	1,200.414	34.8
30–39	115,485	307	588.567	52.2	536.358	57.2	1,075.722	28.5
40–49	60,610	327	492.011	66.5	476.855	68.6	733.534	44.6
50–59	18,089	210	305.299	68.8	297.258	70.6	370.172	56.7
60–69	2,468	77	99.213	77.6	92.922	82.9	107.033	71.9
Total	356,277	1,390	2,185.038	63.6	2,010.583	69.1	3,596.099	38.7

TABLE II. By Policies (*Concluded*).

Issues of 1907 to 1917, Exposed to the Anniversaries in 1918.

Ratio of Actual to Expected Deaths by Three Tables.

Ages at Issue.	Exposures.	Deaths.	M.-A. Table (Select).		Amer. Men Table (Select).		Amer. Table.	
			Expected.	Percent.	Expected.	Percent.	Expected.	Percent.
Summary by Policy Years All Ages Combined.								
1	84,444	217	363.694	59.7	304.519	71.3	785.421	27.6
2	65,744	229	381.604	60.0	327.837	69.9	629.758	36.4
3	52,911	174	326.639	53.3	289.907	60.0	520.522	33.4
4	43,069	187	281.301	66.5	254.528	73.5	436.471	42.8
5	34,223	161	236.316	68.1	224.060	71.9	358.293	44.9
6	26,218	132	190.027	69.5	192.783	68.5	283.563	46.6
7	19,190	110	146.277	75.2	149.341	73.7	214.711	51.2
8	13,806	68	111.265	61.1	114.353	59.5	160.465	42.4
9	9,270	54	78.709	68.6	81.292	66.4	111.644	48.4
10	5,319	37	48.735	75.9	50.626	73.1	67.491	54.8
11	2,083	21	20.471	102.6	21.337	98.4	27.760	75.6
Total	356,277	1,390	2,185.038	63.6	2,010.583	69.1	3,596.099	38.7

TABLE III. By Amounts.

Issues of 1907 to 1917, Exposed to the Anniversaries in 1918.

Ratio of Actual to Expected Deaths by Three Tables.

Ages at Issue.	Exposures.	Deaths.	M.-A. Table (Select).		Amer. Men Table (Select).		Amer. Table.	
			Expected.	Percent.	Expected.	Percent.	Expected.	Percent.
Policy Year One.								
15–19	$ 5,437,200	18,000	16,855	106.8	14,198	126.8	42,021	42.8
20–29	63,921,100	133,700	217,918	61.4	185,896	71.9	516,384	25.9
30–39	70,159,500	112,000	273,514	40.9	223,425	50.1	625,614	17.9
40–49	46,810,000	184,000	255,577	72.0	217,113	84.7	512,662	35.9
50–59	14,463,800	88,500	158,043	56.0	128,457	68.9	245,695	36.0
60–69	1,543,400	21,500	34,377	62.5	28,906	74.4	49,238	43.7
Total	$202,335,000	557,700	956,284	58.3	797,995	69.9	1,991,614	28.0
Policy Years One to Five.								
15–19	$ 17,207,900	66,500	69,558	95.6	57,343	116.0	134,053	49.6
20–29	206,180,200	559,400	883,620	63.3	755,181	74.1	1,687,154	33.2
30–39	235,728,500	602,500	1,141,613	52.8	995,184	60.5	2,158,130	27.9
40–49	162,549,700	884,800	1,206,102	73.4	1,106,949	79.9	1,887,737	46.9
50–59	51,959,000	474,000	786,295	60.3	721,543	65.7	988,510	48.0
60–69	6,048,900	172,500	202,616	85.1	180,813	95.4	226,974	76.0
Total	$679,674,200	2,759,700	4,289,804	64.3	3,817,013	72.3	7,082,558	39.0

TABLE III. By Amounts (*Continued*).

Issues of 1907 to 1917, Exposed to the Anniversaries in 1918.

Ratio of Actual to Expected Deaths by Three Tables.

Ages at Issue.	Exposures.	Deaths.	M.-A. Table (Select).		Amer. Men Table (Select).		Amer. Table.	
			Expected.	Percent.	Expected.	Percent.	Expected.	Percent.
Policy Years Six to Eleven.								
15–19	$ 4,055,100	8,000	19,098	41.9	17,242	46.4	32,575	24.6
20–29	54,305,200	212,500	269,022	79.0	248,480	85.5	466,935	45.5
30–39	67,771,300	296,000	417,009	71.0	429,142	69.0	684,034	43.3
40–49	47,801,500	393,500	535,057	73.5	584,197	67.4	686,557	57.3
50–59	15,966,700	282,000	390,881	72.1	426,283	66.2	429,673	65.6
60–69	2,212,500	84,500	124,857	67.7	125,848	67.1	126,421	66.8
Total	$192,112,300	1,276,500	1,755,924	72.7	1,831,192	69.7	2,426,195	52.6
Policy Years One to Eleven.								
15–19	$ 21,263,000	74,500	88,656	84.0	74,585	99.9	166,628	44.7
20–29	260,485,400	771,900	1,152,642	67.0	1,003,661	76.9	2,154,089	35.8
30–39	303,499,800	898,500	1,558,622	57.6	1,424,326	63.1	2,842,164	31.6
40–49	210,351,200	1,278,300	1,741,159	73.4	1,691,146	75.6	2,574,294	49.7
50–59	67,925,700	756,000	1,177,176	64.2	1,147,826	65.9	1,418,183	53.3
60–69	8,261,400	257,000	327,473	78.5	306,661	83.8	353,395	72.7
Total	$871,786,500	4,036,200	6,045,728	66.8	5,648,205	71.5	9,508,753	42.4

TABLE III. By Amounts (*Concluded*).

Issues of 1907 to 1917, Exposed to the Anniversaries in 1918.

Ratio of Actual to Expected Deaths by Three Tables.

Ages at Issue.	Exposures.	Deaths.	M.-A. Table (Select).		Amer. Men Table (Select).		Amer. Table.	
			Expected.	Percent.	Expected.	Percent.	Expected.	Percent.
Summary by Policy Years—All Ages Combined.								
1	$202,335,000	557,700	956,284	58.3	797,995	69.9	1,991,614	28.0
2	159,596,100	722,000	1,018,321	70.9	882,213	81.8	1,627,834	44.4
3	128,262,000	492,000	882,520	55.7	791,730	62.1	1,353,730	36.3
4	105,268,200	481,000	772,636	62.3	708,139	67.9	1,150,970	41.8
5	84,212,900	507,000	660,043	76.8	636,936	79.6	958,410	52.9
6	65,688,100	440,000	546,920	80.5	566,675	77.6	778,510	56.5
7	48,662,400	319,000	430,680	74.1	448,332	71.2	601,242	53.1
8	34,913,300	187,000	332,437	56.3	347,661	53.8	453,694	41.2
9	23,380,300	204,500	234,502	87.2	246,046	83.1	315,244	64.9
10	13,708,700	81,500	146,424	55.7	154,028	52.9	193,131	42.2
11	5,759,500	44,500	64,961	68.5	68,450	65.0	84,374	52.7
Total	$871,786,500	4,036,200	6,045,728	66.8	5,648,205	71.5	9,508,753	42.4

TABLE IV.

RATIO PERCENT OF ACTUAL TO EXPECTED DEATHS BY AMERICAN MEN TABLE.

Summary by Ages at Issue.

Policy Years:	Policies.								Amounts.							
	One.		One-Five.		Six-Eleven.		One-Eleven.		One.		One-Five.		Six-Eleven.		One-Eleven.	
Ages at Issue.	Mut. Life.	Conn. Mut.	Mut. Life.	Conn. Mut.	Mut. Life.	Conn. Mut.	Mut. Life.	Conn. Mut.	Mut. Life.	Conn. Mut.	Mut. Life.	Conn. Mut.	Mut. Life.	Conn. Mut.	Mut. Life.	Conn. Mut.
15–19	89.7	104.5	101.7	117.7	98.1	61.2	100.9	104.4	82.5	126.8	101.0	116.0	102.9	46.4	101.5	99.9
20–29	77.5	72.4	82.6	71.6	87.4	85.4	83.7	74.9	78.0	71.9	85.1	74.1	89.9	85.5	86.2	76.9
30–39	69.7	54.6	78.1	60.1	85.1	50.5	80.1	57.2	90.8	50.1	92.1	60.5	83.6	69.0	89.9	63.1
40–49	72.5	75.6	78.2	68.1	82.4	69.5	79.6	68.6	67.5	84.7	84.6	79.9	89.3	67.4	86.1	75.6
50–59	71.6	83.5	76.1	66.9	77.4	77.4	76.6	70.6	104.8	68.9	77.1	65.7	74.6	66.2	76.3	65.9
60–69	59.7	102.0	80.3	92.1	97.9	69.9	86.2	82.9	73.3	74.4	78.5	95.4	95.8	67.1	83.7	83.8
Total	73.5	71.3	80.2	69.1	84.6	69.2	81.4	69.1	83.6	69.9	84.5	72.3	84.7	69.7	84.6	71.5

TABLE IV (*Concluded*).

RATIO PERCENT OF ACTUAL TO EXPECTED DEATHS BY AMERICAN MEN TABLE.

Summary by Ages at Issue.

Summary by Policy Years—All Ages Combined.

	Policies.		Amounts.	
Policy Years.	Mutual Life.	Conn. Mutual.	Mutual Life.	Conn. Mutual.
1	73.5	71.3	83.6	69.9
2	79.8	69.9	84.5	81.8
3	82.4	60.0	80.9	62.1
4	84.2	73.5	87.5	67.9
5	83.1	71.9	87.4	79.6
6	81.6	68.5	90.9	77.6
7	80.5	73.7	74.7	71.2
8	92.6	59.5	90.2	53.8
9	78.9	66.4	79.1	83.1
10	96.8	73.1	79.7	52.9
11	94.3	98.4	109.4	65.0
Total	81.4	69.1	84.6	71.5

MORTALITY ON COLORED LIVES—J. D. CRAIG.

VOL. XXI, PAGE 452.

MR. JAMES F. LITTLE:

Mr. Craig's contribution to our knowledge of mortality among insured colored lives will be welcomed not only for its intrinsic value but also because our previously existing supply of information on the subject has been rather scanty.

The three sections which comprise Mr. Craig's material—Ordinary, Intermediate and Industrial—show results in general agreement with each other, and enable us to form a reasonably accurate idea as to the actual excess mortality on colored as compared with white lives.

The data in the Ordinary class—policies for $1,000 or more—are naturally not very extensive. As a result, they show accidental fluctuations, when divided into policy years of experience, which are absent from the larger figures of the other classes. Thus, in Table III, it appears that the mortality experience for policy years 11–15 was abnormally low as compared with both the longer and the shorter durations. Mr. Craig hints that this low figure may possibly be, in part, characteristic, but I think we must regard it as purely accidental in view of the fact that no corresponding minimum appears in the Intermediate Class.

Mr. Craig concludes that in the Ordinary class the effect of medical selection is not traceable beyond the second policy year. Possibly this also is to some extent affected by fluctuation. Taking policy years 1–5, with 503 actual deaths, and policy years 6–10, with 313 actual deaths, we have, by numbers, ratios for the first group of 154 per cent. and for the second of 172 per cent. This would indicate that selection was not without effect even after five years, but it is impossible to draw a definite conclusion. It may be mentioned, in passing, that American experience on white lives shows remarkably little so-called effect of selection after the second policy year as compared with British experience. The following table showing the excess of the ultimate rate at attained age over the select, for durations 2, 3 and 4, in the American and British experiences, respectively, indicates the extent of the difference referred to:

$$1000(q_{30+n}-q_{[30]+n})$$

n	American.	British.
2	0.40	2.08
3	0.37	1.73
4	0.23	1.45

The slender margin between ultimate and select mortality after the second policy year—or, indeed, after the first—characteristic of American experience would render it easy for a comparatively small fluctuation to produce the result Mr. Craig found in the Ordinary class, namely, practically ultimate mortality after the second policy year.

In the Intermediate class, selection apparently benefited only the first policy year and in the Industrial class only the first *calendar* year, or on the average the first six months after issue. These conditions are not peculiar to colored lives, as in the case of white lives there is little, if any, difference between the second policy year and ultimate mortality rates, while in Industrial insurance the second year exhibits the full ultimate rate of mortality on the average, being apparently a little higher at the younger ages and lower at the older.

Mr. Craig takes up the very interesting question as to whether residence in the Southern states of a relatively large proportion of the colored risks accounts, in part, for the excess mortality. Table VII shows that, for colored lives, habitat is of rather less consequence than for white lives. Doubtless the difference found to exist is due rather to inferior sanitation and hygiene than to climatic conditions. Little difference is shown between the Upper Tier and Lower Tier of Southern states for colored risks, although wide differences were found among white lives.

Mr. Craig has shown that the excess of colored mortality over white is not due to difference in habitat to any considerable extent. In this connection it is of interest to compare the ratios of colored to white mortality for the Industrial class given in Table XVI, with corresponding figures deduced from the United States Life Tables, 1920, for the Registration Area:

RATIO OF WHITE TO COLORED MORTALITY.

Age.	Industrial Class.	Colored Males to Total Population (both Sexes.)	Colored Females to Total Population (both Sexes).
20	220%	256%	229%
30	143	230	185
40	147	224	186
50	146	219	178
60	134	178	159
70	110	141	120
80	93	101	92

As the Registration Area includes relatively little of the South, the habitat thereunder is much the same for colored as for white persons. On this count we should look for the higher ratios in the Industrial class column, while a further cause of disparity lies in

the fact that in Registration Area figures the ratio is of colored to total, instead of colored to white. Nevertheless, the insured lives show by far the more favorable figures—sufficient evidence that due care in selection of the risks has been taken.

The Registration Area ratios for males and females were purposely taken as of a combined sexes total in order to bring out the further fact that female colored mortality is much lighter than male. This fact is apparent in Mr. Craig's figures of the Intermediate and Industrial classes, though the contrary appears in the Ordinary class. This latter result, as Mr. Craig suggests, is due to adverse selection, and might, perhaps, justify a rule that colored females should not be insured for more than $500.

The very decided difference according to sex in colored mortality suggests that a substantial portion of the excess mortality among colored males is due to occupation rather than to race. Unfortunately, Mr. Craig has not found it feasible to supply colored occupational mortality rates, and till these are supplied from some source the question cannot be answered definitely. The point is of some importance in connection with group insurances, which sometimes cover a sensible proportion of colored lives. In cases where there is a definite occupational hazard, a question arises as to whether, if the calculated extra mortality due to the presence of colored risks is added to that regarded as due to occupation, there is not some overlapping.

Annual Report of Treasurer of the Actuarial Society of America for Year Ending April 30, 1921.

Total Assets, May 1, 1920.		
Cash	$ 1,463.42	
Investments (at cost)	15,536.78	$17,000.20
Excess of Disbursements over Income, May 1, 1920, to April 30, 1921		670.54
Total Assets April 30, 1921.		
Cash	792.88	
Investments*	15,536.78	$16,329.66

Details of Income.

Annual Dues	$ 2,085.00	
Examination Fees	1,425.00	
Sales of Publications:		
Transactions	1,418.54	
Index to Transactions	10.00	
Medico-Actuarial Reports	946.23	
Actuarial Studies	496.09	
Standard Mortality Ratios	4.98	
Specialized Mortality Investigation	6.00	
Functional Heart Murmur and Intermittent Albuminuria	129.00	
American-Canadian Mortality Investigation	710.00	
Problems and Solutions	240.00	
Advertisements	2,546.50	
Interest and Dividends	698.85	$10,716.19

Details of Disbursements.

Printing, Binding, etc.			
Transactions		$ 4,046.53	
Reprints of Papers		300.33	
Annual Pamphlet		176.00	
Actuarial Studies		293.47	
Problems and Solutions		1,031.34	
Functional Heart Murmur and Intermittent Albuminuria		51.00	
Medico-Actuarial Reports (Binding)		279.32	
American-Canadian Mortality Investigation		142.95	
Expense:			
General		1,115.34	
Examinations			
Postage, etc.	$369.70		
Fees	205.00	574.70	

* No change in Investments since April 30, 1920; see Vol. XXI, 278.

Meetings:			
General	133.03		
Dinners (Net)	85.95	218.98	
Rent		1,400.04	
Storage		172.00	
Moving to No. 256 Broadway		213.75	
Fire Insurance		26.24	
Salary		1,200.00	
Library		2.25	
Biennial Prize		100.00	
Exchange: Loss on Foreign Remittances		42.49	$11.386.73

List of Suggested Subjects for Papers.

1. (*a*) War hazards as shown by the recent war. (*b*) Extra premiums and other methods of compensation for extra war hazard.

2. Effect of war on mortality among civilians.

3. Probable differences in mortality after the recent war from that before the war as a direct or indirect result of the war.

4. The incorporation of accident insurance in life insurance policies with special reference to the double indemnity policy; statistics thereon; the expense of companies under such policies.

5. Practical methods of carrying out compulsory health insurance by the state, by mutual associations and by private offices.

6. (*a*) Rates of premium and reserves for the various disability benefits granted by a life insurance company. (*b*) Premium rates and reserves for accident benefits incorporated in life insurance policies.

7. (*a*) Pension schemes for corporations: with special reference to the methods of providing for present employees. (*b*) State, government and municipal pension schemes: methods of providing for payment thereof, especially in case of those already at the pension ages. (*c*) Private pension schemes for ministers or teachers.

8. Are federal old age pensions feasible or desirable in the United States; if so, how should the practical problems be met?

9. A history of unemployment insurance; its advantages and disadvantages. How could it be made practical in the United States?

10. Valuation of fraternal orders with special reference to the so-called "Mobile" laws.

11. Question of assessment of expenses on a new policy against that policy; the bearing of this question on reserves and dividends, with special reference to level premium reserves.

12. Population statistics: historical sketch of registration systems in America and elsewhere, with particulars of information recorded.

13. A study of the United States census, with reference to (*a*) evidence of improved longevity, (*b*) effect of immigration on death rate, (*c*) comparative death rates in the several states, (*d*) comparison with death rates in other countries.

14. (*a*) Rise and fall in the rate of interest during the last fifty years and a study of the causes thereof. (*b*) Probable future trend of interest rate.

15. (*a*) Investments of life insurance funds. (*b*) Real estate mortgages as investments for life insurance companies. (*c*) Farm loan mortgages as investments for life insurance companies: effect of the new national farm loan system on companies now investing in such mortgages.

16. Methods of analyzing and exhibiting the experience of a company on doubtful or impaired risks, including classification thereof.

17. Suitability of the American Experience Table of Mortality (*a*) as a test of solvency; (*b*) as a basis for premium rates; (*c*) for the apportionment of mortality gains.

18. History of government supervision of life insurance in America and elsewhere.

19. Outline of a system of state (or government) insurance in its various branches, with a discussion of the statistical bases required. History of attempts to create a system of state or government insurance.

20. Group insurance: principles regulating insurance of groups without medical examination, with special reference to information required regarding constitution of groups and to inclusion of old employees now individually uninsurable. Mortality experience.

21. Taxation of life companies in America and elsewhere; comparative study of taxation of life insurance in the several states of the United States, and in the principal countries of Europe, especially Austria, Germany, Great Britain and Italy. Should mutual life insurance companies be taxed by the state: discussion of the equities of the various methods of taxation—premium tax, surplus tax, reserve tax, etc.

22. Life office expenses with special reference to the method of remunerating agents.

23. Apportionment of expenses.

24. Industrial insurance.

25. Re-insurance: principles regulating re-insurance of the whole or a section of one company's business with another company; amalgamation of companies and the laws relating thereto; valuation of assets and methods of valuation and treatment of the several items of liability.

26. History of systems of dividends in America and elsewhere, with special reference to tontine dividends, deferred dividends and annual dividends.

27. Analysis of various methods of investigating the sources of surplus; comparison of the Gain and Loss Exhibit with methods adopted elsewhere.

28. The conservation of existing insurance; steps which may be taken to prevent default in payment of premiums and to counteract surrenders; the part which the granting of policy loans plays in surrenders: discussion of the laws and the practices of the companies regarding cash values and loans.

29. Problems of new life insurance companies.

30. History of surrender values in America and elsewhere, and the laws affecting same: discussion of relationship of non-forfeiture values and reserves, and the probable effect of the present scale of cash values in the investments of companies.

31. Application of a system of perforated cards (Hollerith or similar system) to (*a*) policy records, (*b*) valuation records, (*c*) dividend records, (*d*) mortality experience, and (*e*) an interchange of information and a system of checking between the actuary's and other departments.

32. Life insurance accounting in the United States and Canada: systems of control of receipts and disbursements; relative cost of new and old business; systems of interdepartmental checking and exchange of information and records; accounts required for company's own purposes and for the annual statements required by states and foreign countries.

33. System of books or records for the actuarial department of a life office required for valuation, dividends and mortality experience, and materials for annual statements.

34. Analysis of the forms of reports required by different foreign governments.

35. Methods of valuation in groups and their advantages and disadvantages when applied to an American office: approximate valuations of a section of a company's business.

36. History of reserves held by companies in America and elsewhere, and of the laws regarding reserves: advantages and disadvantages of various reserve systems.

37. History of state and foreign government laws requiring deposits based upon reserves for local business.

38. Any original mortality investigation: country, state, city, company or section of company's business.

39. Original applications of mathematical formulas to life contingencies including mortality tables.

Obituary.

Walter Smith Nichols

Born, November 23, 1841. Died, February 9, 1921.

Thomas Bond Sprague

Born, March 29, 1830. Died, November 29, 1920.

(For Biographical Notes see Presidential Address, pages 10 and 11 of this number.)

Abstract from the Minutes of the Annual Meeting of the Actuarial Society of America, Held in New York, on Thursday and Friday, May 19 and 20, 1921.

Hotel Astor, New York City.
May 19, 1921.

FIRST DAY.

The meeting was called to order by the President, William A. Hutcheson, at 10:30 o'clock A. M.

The following were present:

FELLOWS.

Alsop	Henderson	Perrin
Bagley	Hoskins	Pettegrew
Barber	Howe	Rhodes
Bassford	Howell	Rice
Blackadar, W. L.	Hunter, A.	Rose
Blehl	Hurd	Rutherford
Breiby	Hutcheson	Rydgren
Buchanan	Jackson	Salter
Cameron	Joffe	Sheppard
Cammack	Johnson	Speers
Carpenter	Johnston, A. W.	Stephenson
Cooper	Johnston, F. H.	Stilwell
Craig, J. D.	Kattell	Strachan
Craig, J. M.	King	Strong
Davis	Laird	Tarbell
Dow	Langstaff	Tebbetts
Elston	Larus	Thomas
Fackler, D. P.	Linton	Thompson
Fackler, E. B.	Little	Torrey
Fitzgerald	Mabon	Walker
Flanigan	Macfarlane	Watson, A. D.
Flynn	Maclean, J. B.	Watt
Gaines	Marshall, E. W.	Welch
Gaylord	Milligan	Whitney
Gerhard	Moir	Williamson
Gibb	Morris	Wolfenden
Gore	Mowbray	Wood, A. B.
Hall, A. F.	Murphy	Wood, W. A. P.
Hallman	Papps	Woodward, J. H.
Hardcastle	Parker	Young

ASSOCIATES.

ALLEN	GRAHAM	MORRIS
ALLSTROM	HALLIDAY	MOULTON
ANGELL	HEMSING	PEIRCE
BEERS	HEZLETT	POWELL
BIRKENSHAW	HILL	REICHGOTT
BLISS	HOLMES	REID
BOWERMAN	HUGHES	RILEY
BROWN, J. C.	JORDAN	ROTHSCHILD
BROWN, E. G.	KAUFMAN	SMITH, C. G.
BUTTOLPH	KEYS	SMITH, F. M.
DAVENPORT	KING	SMITH, V. R.
DAVIS	LARKIN	STANLEY
DICKENSON	LITTLE	WARWICK
FISHER	LUNDGREN	WHEELER, R. P.
FRANKS	MCCONNEY	WHEELER, R. A.
GOULD	MILLER	WILLIAMS

President William A. Hutcheson read the presidential address.

The minutes of the semi-annual meeting held in Richmond on October 28 and 29, 1920, were approved as printed in the *Transactions.*

The President announced the award of the biennial prize to Mr. Valentine Howell for his paper entitled "Two Graduations of the American-Canadian Mortality Experience," appearing on page 178 of Volume XXI.

The Secretary reported that at the meeting of the Council:

1. It was determined to increase the price of the *Transactions* to $1.50 for numbers of ordinary size and to increase the price of the Actuarial Studies.

2. An arrangement had been approved whereby in addition to the numbers of the *Transactions* regularly received the members could obtain a bound volume for the year by the payment of $1.00 extra at the beginning of the year as had been announced in circular letter.

3. Closer definition of examinations for Parts I and II of Associateship had been made. This was fully set forth in the President's Address and had been reported in detail in a circular letter.

4. It was determined that in the future the examination papers should not be printed in the pamphlet, since they are printed in the *Transactions,* and sample copies could be furnished by printing an extra supply of papers in the form used in the examinations.

The Treasurer's report was read and on motion approved.

The Society proceeded to the election of officers and three members of the Council, the following being elected:

President ..... William A. Hutcheson.
Vice-President ..... Robert Henderson,
Vice-President ..... Edward E. Rhodes.
Secretary ..... Wendell M. Strong.
Treasurer ..... David G. Alsop.
Editor of Transactions ..... John S. Thompson.

Members of the Council ..... James D. Craig, John M. Laird, M. Albert Linton.

The Society proceeded to the reading and discussion of papers and adjourned at 5:30 P.M. to assemble for dinner at 7:30 P.M.

At the dinner President Hutcheson acted as toastmaster. The speakers were:

Mr. George Graham, President, American Institute of Actuaries,
Mr. A. H. Mowbray, President, Casualty Actuarial Society,
Mr. Ray D. Murphy,
Mr. Walter I. King,
Mr. M. Albert Linton,
Mr. Sherman C. Kattell.

SECOND DAY.

Friday, May 20, 1921.

The meeting was called to order by the President, William A. Hutcheson, at 9:30 A.M.

The meeting was devoted to an informal discussion of the following topics of current interest:

I. *Prevention of Lapses, Surrenders, etc.*

What steps can be taken to promote the continuance in force of recently written business?

II. *Disability (including Sickness) Insurance and Accident Insurance (including so-called Double Indemnity Benefits), either separately or in combination with life insurance.*

(1) The functions of these benefits from Life Insurance point of view.

(2) The extension of the Disability Benefit to cover Temporary as well as Permanent, and Partial as well as Total, Disability.

(3) Respective merits of Cancellable and Non-cancellable contracts.

(4) Limit of amount at risk, and if in combination with life policy, relation between amount of Extra Benefits and amount of policy.

(5) Suitable methods of rating-up for policies providing for Disability Benefits on account of occupation, impairment, etc.; classes of cases not acceptable.

(6) Suitable methods of rating-up for policies providing for Additional Accidental Death Benefits on account of occupation, impairment, etc.; classes of cases not acceptable.

(7) Difficulties of combining Double Indemnity Benefits with Life Income policy (where the sum insured is decreasing).

(8) Should Total and Permanent Disability Benefits be payable for the duration of an acute disease, such as typhoid, of which the insured dies?

(9) Is a two-year rather than a one-year Incontestable clause in a policy, which includes disability or double indemnity benefits, important as a safeguard; and if so, is such two-year clause equally important as a safeguard in case of a policy without such benefits?

(10) Is it permissible to provide in the policy that payment of additional accidental death benefits shall not be made if death occurs after two years as a result of aviation, submarine travel, suicide, etc., notwithstanding the two-year Incontestability clause required by the laws of many States?

III. *Corporation Insurance—Insurable Interest.*

What facts determine the insurable interest of a corporation in the life of an officer or employee? What risk is incurred by a company if it issues corporation insurance and there is an insufficient insurable interest?

IV. The situation with regard to *Modified Preliminary Term Legislation.*

V. *The treatment of rated-up risks* when the cause of rating has been removed, with reference to both (*i*) ratings for occupation and (*ii*) ratings for physical impairment.

Examinations of the Society.

Held on May 25 and 26, 1921.

Examination Committee

OLIVER W. PERRIN ..... Chairman
ARTHUR COBURN, RAY D. MURPHY ..... Vice-Chairmen

W. L. BLACKADAR, JOHN J. COOPER, JAMES S. ELSTON, MURAT L. JOHNSON, JOHN R. LARUS, WM. MACFARLANE, JOSEPH B. MACLEAN, EDW. W. MARSHALL, DWIGHT A. WALKER

EXAMINATION FOR ADMISSION AS ASSOCIATE

PART I

1. (*a*) Find the value of

$$\frac{.08\dot{3}}{4.\dot{4}} + \frac{3.3142857}{.00\dot{9}} \div \sqrt{.02\dot{7}}$$

(*b*) Simplify

$$\left(2\tfrac{3}{4} + 2\tfrac{1}{2} \text{ of } \frac{7}{3\frac{4}{5}} - \frac{1\frac{2}{3}}{2\frac{1}{2}}\right) \div \left(2 - \frac{151}{\sqrt{51984}}\right)$$

2. (*a*) Three cyclists ride at rates of 639, 615 and 603 yards per minute. They start together in the same direction round a circular track, one quarter of a mile in circumference. How long after they start and at what part of the track will they next be together?

(*b*) A man had \$20,000 to invest. He purchased \$8,700 Union Pacific 4% bonds at 103 and \$7,300 Canadian 3½% bonds at 93½, and invested the balance as far as he could in bank stock, par 100 at 149¼, paying half yearly dividends of 4%. What was the gross amount of his investment, he having paid 1/8% brokerage on each class of security? What amount of annual income does he actually receive and what is the percentage of this to his investment?

3. (*a*) Find the H.C.F. of

$$12x^4 - 42x^3 - 24x^2 + 162x - 108$$
$$21x^4 - 189x^2 - 84x + 252$$

and

$$24x^4 - 12x^3 - 228x^2 + 432$$

(*b*) Factorize one of the following expressions:

$$x^4 + 5x^3 - 18x^2 + 8x$$

or,
$$(x + y + z)^3 - x^3 - y^3 - z^3.$$

4. (*a*) Derive the relationship that must be satisfied between the coefficients of the quadratic equation $ax^2 + bx + c = 0$ to give real roots.

(*b*) Solve the equations:

$$(1)\quad \frac{x^2+1}{x-1} - \frac{4(x-1)}{x^2+1} = \frac{21}{5}$$

$$(2)\quad \begin{cases} x^2 + xy = 14 - x \\ y^2 + xy = 28 - y \end{cases}$$

5. (*a*) A traveller walks a certain distance; if he had gone 1/2 mile an hour faster, he would have walked the distance in 4/5 of the time; if he had travelled 1/2 mile an hour slower, he would have been 2 1/2 hours longer on the road. Find the distance he walked.

(*b*) I look at my watch between 3 and 4 o'clock and on looking again between 8 and 9 I observe that the hands are exactly interchanged. At what time did I look first?

6. (*a*) Show that

$$\frac{1}{\sqrt{11 - 2\sqrt{30}}} - \frac{3}{\sqrt{7 - 2\sqrt{10}}} - \frac{2}{\sqrt{2 + \sqrt{3}}} = 0$$

(*b*) Simplify

$$\left(\frac{a^{6x} - 1}{a^{3x}} - \frac{3a^{2x} - 3}{a^x}\right) \div (a^x - a^{-x}) + (a^x + a^{-x})^2$$

7. In expansion of

$$\left(3\sqrt{x} - \frac{1}{6\sqrt[3]{x}}\right)^7$$

find (*a*) coefficient of x;

(*b*) numerically greatest term when $x = \frac{1}{64}$.

8. (*a*) Terms equidistant from a given term of an Arithmetical Progression are multiplied together; show that the differences of the successive terms so formed are in arithmetical progression.

(*b*) The population of a town is 10,000 and it loses 2% annually by death and gains 3% annually by births. Every year 200 people move into the town and 100 move away. Express in the simplest form what the population will be at the end of 20 years.

9. (*a*) If $(1+x)^n = C_0 + C_1x + \cdots + C_nx^n$ show that

$$n(1+x)^{n-1} = C_1 + 2C_2x + \cdots + nC_nx^{n-1}.$$

(*b*) Using the binomial expansion, derive an expression for the total number of combinations of n things taking some or all of them at a time.

(*c*) Illustrate how the Binomial Theorem may be applied to the expansion of a multinomial.

10. (*a*) Find for what value of r the number of combinations of n things r at a time is greatest (1) if n is an even number; (2) if n is an odd number.

(*b*) There are three candidates for a certain office and twelve electors. In how many ways is it possible for them all to vote and in how many ways will the votes be equally divided among the candidates?

11 (*a*) Show that the perpendiculars from the vertices of a triangle to the opposite sides meet in a point.

(*b*) If from a point within an equilateral triangle, perpendiculars are drawn to the three sides, show that the sum of these lines is the same wherever the point is situated and is equal to the perpendicular from any vertex to the opposite side.

12. (*a*) $ABCD$ is a parallelogram and L and M are the middle points of AB and CD. Show that DL and BM trisect the diagonal AC.

(*b*) Find logarithm of 128 to base $\sqrt[3]{4}$.

13. (*a*) If $A + B + C = 180°$, show that

$$\operatorname{Cos} A + \operatorname{Cos} B + \operatorname{Cos} C = 1 + 4 \operatorname{Sin} \frac{A}{2} \operatorname{Sin} \frac{B}{2} \operatorname{Sin} \frac{C}{2}.$$

(*b*) Prove that $\operatorname{Tan} 2A = \dfrac{\operatorname{Cos} A - \operatorname{Cos} 3A}{\operatorname{Sin} 3A - \operatorname{Sin} A}$.

and that $\operatorname{Sin}(\operatorname{Sin}^{-1} x + \operatorname{Sin}^{-1} y) = x\sqrt{1-y^2} + y\sqrt{1-x^2}$.

14. (*a*) Under what conditions are the lines given by the equations $ax + by + c = 0$ and $a'x + b'y + c' = 0$, (1) parallel, (2) perpendicular to each other.

(*b*) Find the perpendicular distance from the point x_1y_1 to the line $ax + by + c = 0$.

15. (*a*) Find the equation of the line joining the point 1, 1 to the intersection of the lines:

$$3x + 4y = 2 \text{ and } x - 4y + 5 = 0.$$

(*b*) Given the circle $x^2 + y^2 = r^2$ find the equation of

(1) The tangents parallel to $\frac{x}{a} + \frac{y}{b} = 1$,

(2) The tangent at the point x_1y_1.

16. Prepare Profit & Loss account and Balance Sheet as of December 31, 1920 of the Jones Co. Ltd., from the following particulars:

Capital Stock \$100,000; Trading Account gross profit \$65,000; Accounts receivable \$80,000; Accounts payable \$45,000; Income Tax \$3,685; Rent paid in advance \$400; Real Estate \$42,000; Bills payable \$4,500; Bills receivable \$5,000; Cash \$23,400; Office furniture \$4,500; Reserve for bad debts \$4,250; Inventory \$29,565; Profit & Loss Account 1919, Cr. \$4,500; Dividends paid \$7,000; Salaries and office expenses \$27,700.

Provide 10% depreciation on office furniture and make reserve for bad debts equal to 5% of accounts receivable.

PART II.

1. (*a*) Prove by mathematical induction that

$$1^3 + 2^3 + 3^3 + \cdots + n^3 = \frac{n^2(n+1)^2}{4}$$

(*b*) If $(1 + x)^n = c_0 + c_1x + c_2x^2 + \cdots + c_nx^n$ show that

$$c_0 - \tfrac{1}{2}c_1 + \tfrac{1}{3}c_2 - \cdots + (-1)^n \frac{c_n}{n+1} = \frac{1}{n+1}$$

2. (*a*) Find in their simplest forms the general terms in the expansions of $(1 - x)^{-n}$ and $(1 - x)^{-2}$.

(*b*) Find the nth term and the sum to n terms of the series $3 \cdot 4 \cdot 7 \cdot 14 \cdot 29 \cdots$.

3. If s_n denote the sum of the first n natural numbers, show that

(*a*) $(1-x)^{-3} = s_1 + s_2x + s_3x^2 + \cdots$ and hence show that

(*b*) $2\{s_1s_{2n} + s_2s_{2n-1} + \cdots + s_ns_{n+1}\} = \dfrac{\lfloor 2n+4}{\lfloor 5 \lfloor 2n-1}$

4. (*a*) Express as a series the logarithm to base e of the product of $(1+ax)^{\frac{1+ax}{2a}}$ and $(1-ax)^{\frac{1-ax}{2a}}$.

(*b*) Show that

$$2\log_e n - \log_e (n+1) - \log_e (n-1) = \frac{1}{n^2} + \frac{1}{2n^4} + \frac{1}{3n^6} + \cdots$$

5. (*a*) Each term of a series is composed of r factors in Arithmetical Progression, the first factor in each of the terms being in the same Arithmetical Progression, show how to find the sum of n terms of the series.

(*b*) The nth term of a series is

$$\frac{1}{n(n+2)(n+4)};$$

find the sum to n terms.

6. (*a*) Show that the infinite series

$$\frac{1}{1^p} + \frac{1}{2^p} + \frac{1}{3^p} + \cdots$$

is divergent except when p is positive and greater than 1.

(*b*) Test for convergency the series whose nth terms are

(1) $\sqrt{n^2+1} - n$. (2) $x^{n+1}\log(n+1)^q$.

7. (*a*) If p_1, p_2, p_3, are the respective probabilities that three independent events will happen separately, write down expressions for the following probabilities:

(1) that all will fail;
(2) that the first two will happen and the third fail;
(3) that one at least will happen;
(4) that two at least will happen.

(*b*) A and B are each to throw once with two dice; find the chance that their throws will be equal.

8. A bag contains $\dfrac{n(n+1)}{2}$ counters of which one is marked 1, two are marked 4, three are marked 9 and so on; a person puts in his hand and draws out a counter at random and is to receive as many dollars as the number marked n it; find the value of his expectation.

9. Two persons, A and B, play a series of games with each other, their respective chances of winning any particular game being as 3:2. Assuming that the match is to be decided in favor of the first person who wins two games in succession, show that A's initial chance of winning is 63/95 while if he wins the first game, his chance is increased to 15/19.

10. (a) Show that the odds are 11:3 against a month selected at random containing portions of six different weeks.

(b) Out of n occasions in which an event of probability p is in question, on what number of occasions is it most likely to happen?

11. The *a priori* odds against a certain event having happened are 10^{14} to 1. Prove, however, that the odds are about 2 to 1 that it did happen if it is vouched for by 15 independent witnesses, each of whom makes a correct assertion 9 times out of 10.

12. (a) If all the terms except u_5 of the series $u_1, u_2 \cdots u_9$ be given, find the value of u_5 expressed as a function of the other terms of the series.

(b) Show that $u_x = u_0 + \left(a_0 - \frac{c_0}{\underline{|3}}\right)x + \left(\frac{b_0}{\underline{|2}} - \frac{d_0}{\underline{|4}}\right)x^2 + \frac{c_0}{\underline{|3}}x^3 + \frac{d_0}{\underline{|4}}x^4$

where a_0, b_0, c_0, d_0 are central differences.

13. (a) If $u_1 = 4$, $u_2 = 30$, $u_3 = 120$, $u_4 = 340$, $u_5 = 780$ and $\Delta^4 u_x$ is constant, find an algebraical expression for u_x.

(b) Derive the following summation formula

$$\int_0^{2n} u_x dx = \frac{n}{3}(u_0 + 4u_n + u_{2n}).$$

14. Show that the operators D and $e^{\frac{d}{dx}}$ are equivalent, and prove that

$$\Sigma_0^{\alpha} u_x = \int_0^{\alpha} u_x dx + \tfrac{1}{2}u_0 - \frac{1}{12}\frac{du_0}{dx} + \frac{1}{720}\frac{d^3u_0}{dx^3} \cdots.$$

15. (a) Find $\frac{dy}{dx}$ in the following cases:

(1) $y = \sin^{-1}\frac{x}{\sqrt{1+x^2}}$

(2) $y = u^v$ where u and v are both functions of x.

(*b*) Find the value of

$$(1)\ \int \frac{x^3 - 3x^2 + x}{x^2 - 3x + 2}\,dx$$

$$(2)\ \int \log \sqrt{1 - x}\,dx$$

16. (*a*) Derive Taylor's Theorem.

(*b*) Apply Maclaurin's Theorem to expand a^x.

(*c*) State Leibnitz's Theorem for finding the nth derivative of a product.

PART III.

1. (*a*) Explain the continuous method of calculating and verifying a table of $a_{\overline{n}|}$

(*b*) Assuming interest tables are not available, show how to approximate very closely the rate of interest in an annuity-certain when the term is long.

(*c*) Given that the amount of an annuity-certain of 1 is 26.87037 and that the present value of the same annuity is 14.87748, find rate of interest.

2. (*a*) Explain clearly what is meant by the term "Force of interest." Is it of theoretical value only? If not, state two instances in which it may be of practical use in financial computations.

(*b*) State briefly the method commonly used by bankers in discounting notes. How would the corresponding effective rate of discount in the case of a long term note compare with that of a short term note?

3. A manufacturer has \$1,000,000 of bonds maturing June 1st, 1921. He proposes to redeem these by a new issue of semi-annual bonds maturing June 1st, 1941, bearing interest at the rate of 9% until June 1st, 1926, 7% thereafter until June 1st, 1931, 6% thereafter until 1936 and 5% thereafter. If similar long term investments are yielding 8%, how much of the new issue should he offer for the old?

$$\text{Given } (1.04)^{-10} = .67556$$
$$(1.04)^{-40} = .20829$$

4. Write down the values of the following probabilities and in addition the symbols when possible:

(*a*) That at least one of the lives (x) and (y) will fail in n years.

(*b*) That the second death of (x) and (y) will happen in the nth year from the present time.

(*c*) That out of five lives all aged x one designated life A will die within a year and be the first to die.

(*d*) That out of 25 persons aged x, five designated individuals at least will die within a year.

5. (*a*) Define and find an expression for $e_{x|y}$

(*b*) Having given the l and d columns of a mortality table, how would you calculate the value of $\mathring{e}_{xy}$?

(c) Write an expression for ${}_{n-1}|q^1_{x:y}$

6. Find expressions for the value of

(*a*) $Q^{\ 2}_{1\ xyz}$

(*b*) $Q^{\ 3}_{1\ 2\ xyz}$

7. (*a*) Explain what the following symbols mean and derive their values: $(Ia)_{x\overline{n}|}$, $(IA)^1_{x\overline{n}|}$

(*b*) Find the net annual premium for a whole life policy with full return of premiums without interest if death occur during the first five years; three-quarters return during the next five years; one-half return during the next five; and one-quarter return during the next five. Are there any practical objections to a policy of this kind?

8. Give in outline the history of the invention and use of the commutation columns.

9. Find the net annual premium for an annuity deferred n years and payable thereafter until the death of the survivor of (x) and (y). What two methods may be used and what is the practical objection to one of these methods?

10. Three sisters (x), (y) and (z) are to divide equally among the survivors the income from an estate as long as any survive, but if all three die, the income is to go to a brother (w). Express in single-life and joint-life annuities the value of the share of

(1) any one of the sisters.

(2) the brother.

11. Write an expression for the net annual premium, payable for $(65 - x)$ years on a life now aged x to provide an insurance

of \$1000 to age 65 and an annuity of \$100 per annum, beginning at age 65, given $a_{65} = 12.45$.

What modification should be made in this contract on account of practical considerations?

12. (*a*) Prove that the value of a temporary annuity-due to (x) for n years, payable half-yearly, is approximately

$$\tfrac{1}{4}(3a_{x\overline{n}|} + a_{x\overline{n}|})$$

(*b*) Give the algebraical proof that

$$a_x = \Sigma v^n(1+i)\frac{(1+i)^n - 1}{i}{}_{n-1}|q_x - 1$$

13. (*a*) Derive the approximate value of an annuity providing for sixteen yearly payments to a person aged x, the first payment being due at the end of two and one-half years. Assume you have a table of temporary life annuities.

(*b*) Deduce a formula for the net annual premium for an insurance payable if a life aged x dies within the next five years, or if he lives five years and dies after another life now aged y.

14. (*a*) Explain the method of constructing an annual premium conversion table and illustrate by calculating the first five values of a 3% table given d at $3\% = .029126$.

(*b*) A select life (x) desires a contingent assurance against (y) with the proviso that, if he be alive at the death of (y) he shall have the option of converting his policy into an ordinary life contract at current age without medical examination. Derive the single premium.

15. (*a*) Explain the symbols l_x, L_x, T_x, Y_x.

(*b*) Given a community with a stationary population and assuming you have access to the census tabulations and death-registers for one or more years, how would you construct a mortality table?

16. A system of compulsory education is introduced into a community embracing all children from age of seven to fifteen inclusive. The present number of such children is 10,000 but the birth rate in the community, previously stationary, has been increasing at the rate of 4% per annum during the past four years. Estimate the number of children under education at the end of twenty years and how many will have passed out from the system by attaining age 16, during the period.

PART IV.

1. Give a formula for determining the value of $\bar{a}_{\overline{x:\overline{n}|}:y}$ and draw up a schedule showing how you would perform the calculation.

2. (*a*) Express ${}_{t|}\mathring{a}_x^{(m)}$ in terms of curtate life annuities.

(*b*) Holmes Ivory gives the expression

$$a_{y|x}^{(m)} = a_x - a_{xy} - \frac{m-1}{2m} A_{xy}^{1}$$

Establish and explain this formula by general reasoning.

3. (*a*) State what is meant by the Law of Uniform Seniority and elucidate your remarks by a mathematical analysis.

(*b*) Which rule, Simpson's or Milne's, is the better for calculating the value of a three life last survivor annuity? Give reasons.

4. (*a*) Show that the central death rate is approximately equal to the value of the force of mortality at an age half a year older.

(*b*) For a mortality table that follows Makeham's Law, how would you deduce the value of p_x in terms of the constants, starting with the equation $\mu_x = A + Bc^x$.

5. (*a*) What do the following integrals mean:

$$(1)\ \frac{1}{l_{xyz}} \int v^t l_{x+t}(l_y - l_{y+t}) l_{z+t} \mu_{x+t} dt$$

$$(2)\ \frac{1}{l_{xyzw}} \int v^t l_{w+t} l_{x+t} l_{y+t} (l_z - l_{z+t}) \mu_{y+t} \bar{A}_{w+t\,:\,x+t}^{\,1} dt$$

(*b*) Express the following functions as integrals:

(1) $\bar{a}_{\overline{xy}|z}$

(2) $\bar{a}_{yz}^{1}{}_{|x}$

6. Given Maclaurin's theorem:

$$u_x = u_0 + x \frac{du_0}{dx} + \frac{x^2}{\underline{|2}} \frac{d^2 u_0}{dx^2} + \cdots$$

derive the approximate relation:

$$\int_0^{\infty} u_x dx = \frac{n}{3} \{u_0 + 2(u_{2n} + u_{4n} + u_{6n} \cdots) + 4(u_n + u_{3n} + u_{5n} + \cdots)\}$$

7. (*a*) Explain clearly what is meant by the Retrospective and Prospective Methods of computing policy values. Derive an ac-

cumulation formula suitable for the continuous computation of ordinary life policy reserves.

(*b*) Discuss the reasons for the adoption of net level premium method of valuation by the old life companies in the eastern states. Why were the office premium and the lapse rate methods eventually discarded?

8. (*a*) Show that

$$ {}_nV_x = 1 - \frac{1 - A_{x+n}}{1 - A_x} $$

$$ = \frac{P_{x+n} - P_x}{P_{x+n} + d} $$

(*b*) Give a formula for the tenth year terminal reserve on a whole life insurance policy under which the sum insured is payable at the moment of death and the premiums are true weekly (momently) premiums payable for 20 years or until prior death.

9. Prove that the expected cost of insurance under a whole life policy, subject to an annual premium payable throughout life, increases with the duration of the insurance if, at all ages on the basis of the valuation mortality table and rate of interest $\Delta^2 a_{x+n}$ is algebraically $> i\Delta a_{x+n}$.

10. (*a*) Write two expressions for the value of ${}_{n+\frac{r}{m}}V_x$ and prove their identity.

(*b*) Under what conditions may we use mean reserves to value policy liabilities at the end of a calendar year?

11. (*a*) Discuss the effects of a change in the rate of mortality upon policy-values.

(*b*) Explain a method of determining the relative magnitude of policy reserves by a new mortality table as compared with a widely used table without calculating the tables of reserves.

12. (*a*) What are the fundamental differences in the attitude of the state towards life insurance institutions in Great Britain, Canada and the United States?

(*b*) What outstanding contributions to the science of life contingencies did the following men make: Halley, Sheppard Homans, Price, De Moivre, G. F. Hardy.

13. (*a*) Sketch the principal clauses in a group blanket policy of life insurance, such as is given to the employer.

(*b*) Draft a clause covering misstatement of age under a life annuity contract.

14. Draft a rider for issuance with a whole life monthly income-certain policy, the rider to provide for continuous income to the beneficiary.

15. Define the following symbols used in total and permanent disability calculations:

(*a*) r_x (*c*) $a_{x\overline{n}|}^{(n)}$

(*b*) r'_x (*d*) $a_x^{(i)}$

(*e*) $a_{x:\overline{n-1}|}^{(i\overline{n}|)}$

16. (*a*) Indicate how premiums for total and permanent disability benefits are derived by the pension-fund method.

(*b*) Write the formula according to any method for the annual extra premium payable until age 60 for waiver of premiums and an immediate annuity of $10.00 per month, if disability occur before attaining age 60, the benefits being incorporated in an ordinary life policy for $1,000.00.

EXAMINATION FOR ADMISSION AS FELLOW. PART I.

1. Assuming that you are responsible for the planning, installation and use of a perforated card system for making mortality investigations in a large company:

(*a*) What data would you provide for on the perforated card?

(*b*) Outline the steps to be followed in gathering and punching the data on the card.

(*c*) Would you use the "Life Year," "Policy Year" or "Calendar Year" method? State the reasons for your choice.

2. State the fundamental requirements of a good graduation and explain clearly what tests you would apply and how you would apply these tests in determining which of several given graduations of a mortality experience most nearly meets these requirements.

3. What is meant by "Osculatory Interpolation"? In what circumstances is such a process applicable to the construction of mortality tables? Derive a formula for osculatory interpolation based on constant third differences.

4. What instructions, regarding the following points, were

given to the companies which contributed to the American-Canadian Mortality Investigation:

(*a*) Duration of Insurance?

(*b*) Policies to be omitted?

Give the reason in the latter case.

Describe the method of *tabulation* used in obtaining the Exposed to Risk for the Select Tables.

5. (*a*) State the characteristics of the new American Annuitant Mortality Table. In a general way how do the annuity values for a given interest rate compare by sex and age with those of the McClintock and British Offices Annuity Tables?

(*b*) Was the new table based on lives, policies or amounts and why?

(*c*) Describe the method used in graduating the tables.

6. (*a*) Upon what statistics were the rates of disability and of mortality amongst active and disabled lives based in the construction of Hunter's Disability Tables?

(*b*) Explain clearly whether they are select, aggregate or ultimate tables giving the reasons underlying the adoption of the basis finally employed in their construction.

7. (*a*) How would you frame a standard table for maximum and minimum weight by height and age for the acceptance of standard risks?

(*b*) Give some indication in a general way of the range of weights which would be included and discuss some practical considerations to be kept in view in using such a table.

(*c*) How would a table of average weights compare with a table of "best mortality" weights?

8. State how you would treat the following applicants for insurance and give your reasons:

(*a*) A banker, age 45, height 5′8″, weight 209 lbs., systolic blood pressure 155, otherwise seemingly normal, applying for $50,000. Ordinary Life.

(*b*) A man of average weight and height, physical examination satisfactory, reported for albuminuria two years ago but none found at this time.

(*c*) Man, age 24, height, 6′0″, weight, 143 lbs., occupation steel grinder.

(*d*) A missionary going to the interior of China.

9. (*a*) On what terms would you issue a policy to an applicant who has had an operation for cancer within ten years? What surrender values would you allow?

(*b*) Your company accepts lives sub-standard on account of occupation or impairment by basing rates on a series of mortality tables each constructed as a constant percentage for all ages of the normal mortality rates:

(1) How would you treat requests for removal of extra premium several years after issue where insured based request on change to a non-hazardous occupation, or on elimination of impairment?

(2) What surrender provisions would you include in such policies and on what basis would you compute the values?

10. On the basis of what mortality table or tables, rate of interest, loading and commission would you calculate gross premiums for:

(*a*) A non-participating single premium life annuity providing for the return in a lump sum at death of the annuitant of the excess, if any, of the single premium over the total annuity payments made?

(*b*) A non-participating single premium life annuity?

(*c*) The extra premium on a continuous installment policy to provide for the continuance of the installments to the beneficiary after (1) twenty years certain, (2) five years certain?

11. (*a*) Compare the usual system of loading life insurance premiums in the United States with the British System as described by Sprague and others.

(*b*) How would you determine the non-participating office premium for a ten year term policy carrying the option to convert to ordinary life at the end of the term without medical examination?

12. How would you compute the reserve liability to be set up at the end of the year to cover a large number of policies containing:

(*a*) A policy provision that double the face of the policy will be paid in event of accidental death?

(*b*) A continuous installment provision on which the calculated additional reserve is often negative?

13. Outline any method with which you are familiar of making a policy valuation on the paid-for basis as of December 31st and give a set of detailed instructions for the guidance of clerks in using the method—with particular reference to the handling of new business and of changes, terminations and restorations.

14. Your company wishes to set up special reserves to cover the following contingencies. How would you compute these reserves and would you consider a special reserve necessary in every such case?

(*a*) Provision for future expenses under paid-up and limited payment policies after becoming paid-up by their terms.

(*b*) The right on the part of the policyholders under policies already lapsed to demand restoration.

(*c*) Extra mortality hazards covered by single or temporary extra premiums.

15. Which one of the following methods of making a change from the twenty year endowment plan to the ordinary life plan as of original date of issue would give the larger allowance and which would be the more equitable? Give reasons.

(*a*) Allow difference in reserves in cash.

(*b*) Allow cash value of the part of the endowment policy that would have been purchased by the excess of the (office) endowment premium over the life premium.

16. (*a*) An annuitant under a single premium life annuity contract providing for an annual payment of $1000.00 wishes to change the contract to the joint and survivorship plan for a reduced annual payment, bringing in his wife. State on what terms you would make the change, showing how you would determine the reduced amount of income.

(*b*) The beneficiary under an ordinary life continuous installment policy having died, the insured wishes to designate a new beneficiary to receive the life income after the installment certain period. What would be your requirements, assuming that the change must be made as of original date of issue (1) two years from such date (2) fifteen years from such date? How would you obtain the cost of change?

PART II.

1. Write a short account of the development of methods of surplus distribution in Great Britain and in America commenting briefly on the various plans to which you refer.

2. A company uses the following two-factor dividend formula:—1¼% of initial reserve, 25% of cost of insurance on American Table. Gross premiums contain loading of 12% of ordinary life net premiums plus 12% of net premiums for particular plan. The mortality experience of the company parallels the AM experience and after deducting from the mortality savings the excess of expenses over loadings there remains enough gain to cover the 25% mortality distribution made according to formula. The excess interest realized by the company is 1¼%. Outline the investigation necessary to determine whether or not the mortality return of 25% is equitable for all ages and plans. If found inequitable, what type of formula would you substitute?

3. Describe fully the asset share method of annual surplus distribution, stating how you would obtain the factors needed.

4. A company carries policies in foreign currency on its books at the par of exchange but receives premiums and pays claims, dividends, etc., by drafts sold and bought at varying current rates. What entries in Income and Disbursements and in the Gain and Loss Exhibit of the Convention Blank will arise on this account?

5. Show clearly how you would compute the following Gain and Loss Exhibit items:

(*a*) Net income from investments if bonds are carried on the amortized basis.

(*b*) Net expected disbursements to annuitants.

6. What are the main points of difference between the financial statements rendered by life insurance companies to (1) The Board of Trade under the Assurance Companies' Act of Great Britain, (2) Insurance Department of Dominion of Canada, (3) Insurance Departments in the United States?

7. (*a*) State briefly the fundamental factors that should be taken into account in judging of the security of a Public Utility Bond.

(*b*) What relative depreciation do Public Utility Bonds show as a class compared with other classes of bonds in which life insurance companies invest and why?

8. Discuss the following classes of securities with reference to their suitability for the investment of life insurance funds:—

(*a*) Equipment Bonds.
(*b*) U. S. Government Certificates of Indebtedness.
(*c*) Mortgages on new residential property in middle class urban districts.
(*d*) Loans on store and office buildings.

9. What restrictions are imposed by the statutes of New York State *or* of the Dominion of Canada as to the investments of life insurance companies?

10. (*a*) What is a cycle of trade? List in order the main symptoms of the various phases of a cycle of trade. At what part of the current cycle are we now situated?

(*b*) What departments of the life insurance business are affected at the various stages of the cycle?

11. What provisions, designed to prevent panics due to money stringency, exist in the banking systems of the United States, England and France, respectively?

12. (*a*) Define the legal terms: Estoppel, Waiver and Materiality and give instances where they might be used in connection with litigation by or against a life insurance company.

(*b*) State briefly the trend of court decisions construing the incontestable provision. What bearing does this construction have on other provisions of the policy contract, particularly the usual forms of provisions for total and permanent disability and double indemnity?

13. State and compare alternative methods of constructing a salary scale for use in calculations in connection with a large pension fund.

14. A contributory pension scheme is to be established for the employees of a large bank providing for a pension upon disablement or at 65 of 2% of the aggregate salary received.

(*a*) What rates of mortality, disability and interest would you employ in making a valuation?
(*b*) Deduce the formula for the reserve liability for a specific age and duration per unit of present salary required to provide the disability benefit. Assume that the actual salary received in the past has been in accordance with the standard scale.

15. Would you take the element of lapse (or "secession") into account in the valuation of the policy liabilities of a Fraternal Association? In general, what would be the effect of doing so? Give reasons.

16. How would you determine the amount of liability to set up at the end of the year under the following contracts, first, while insured is active, second, during payment of weekly indemnity on account of temporary or of permanent disablement:—

(*a*) Cancellable Accident and Health policies providing for aggregate maximum limit of 52 weeks' indemnity?

(*b*) Non-Cancellable Accident and Health policies providing for an aggregate maximum limit of 208 weeks' indemnity under disability preventing the insured from engaging in his usual occupation, but providing a life annuity upon total and permanent disablement which prevents insured from engaging in *any* occupation for profit?

Results of Examinations.

The following is a list of those who passed the examinations held by the Society on May 25 and 26, 1921:

ASSOCIATESHIP.

Part I.

Albright, L. M. (Miss)
Armstrong, E. C.
Armstrong, W. H.
Barnsley, R. C.
Barnum, F. S. (Miss)
Berger, E. G. (Miss)
Booke, S.
Brown, R. G.
Bunyan, L. H.
Burian, O. J.
Campbell, F. W.
Corcoran, W. M.
Crysdale, J. P.
Cummings, L. D. (Miss)
Dandy, J. P.
Davis, R. (Miss)
Dewey, H. W.
Dodd, T. K.
Garabedian, H. A.
Gauley, R. J. P.
Geddes, G. W.
Gilmour, N.
Guest, R. C.
Halliday, F. F. (Miss)
Hammer, H. H.
Harris, E. R.
Herman, J. R.
Hollenberg, M. H.
Hutchison, G. P. (Miss)
Jackson, H. H.
Jacoby, O. N.
Jamison, D. M. (Miss)
Johanson, F. O.
Johnson, E. (Miss)
Kineke, F. D.
Lienhard, J. B.
Lindman, E. L.
Link, J. C.
Marsh, J. A.
Martin, G. S.
Neil, J. B.
Olson, H. L.
Paisley, A. B.
Poland, G. W.
Prentice, G. T.
Rabb, K. S.
Shepherd, E. I.
Smith, L. G.
Smith, H. L.
Sosnow, G. Y.
Taylor, J. E. (Miss)
Taylor, C. A.
Terryberry, W. W.
Whitworth, G. E. (Miss)
Wood, J. A.

Part II.

Brown, R. G.
Barnsley, R. C.
Bjorn, W.
Boyd, L. T.
Corcoran, W. M.
Dandy, J. P.
Darkow, M. D. (Miss)
Dewey, H. W.
Dodd, T. K.
Ehrenclou, O. A.
Geddes, G. W.
Haradon, R. S.
Herman, J. R.
Hughes, H. Y. (Miss)
Hughes, N. M.
Jackson, H. H.
Jacoby, O. N.
Keachie, F. B.
Lehenbauer, B. G.
McDonald, W. R.
McLachlan, W. (Miss)
McLaren, H. A. F. (Miss)
Martin, G. S.
Martin, L. L.
Montgomery, V.
Morrison, H. P.
Oglesby, E. J.
Olson, H. L.
Paterson, I. L. (Miss)
Phillips, J. T.
Putnam, F. B. (Miss)
Robbins, R. B.
Shepherd, E. I.
Smith, H. L.
Taylor, M. I. (Miss)
Terryberry, W. W.
Thompson, A. R.
*Turnbull, J.
Vogel, F. G.
White, H. O.
White, J. E.
Wilder, R. L.

Part III.

Ault, G. E.
Barnsley, J. C.
Beatty, J. G.
Beaupre, V. E.
Bere, G. S.
Bourke, G. W.
Cale, C. E.
Carver, H. C.
Creuss, L.
Cronin, S. E. (Miss)
Harrison, W. H.
Holmes, G. L.
Holmes, J. (Miss)
Kelton, W. H.
McLachlin, J. L.
Mather, A. E. (Miss)
Myers, G. E.
Porter, E. A.
Saunders, J. L. (Miss)
Skilton, G. W.
Stewart, A. M. (Miss)
Stowe, H. J.

* Part I. Not yet passed.

PART IV.

Barnsley, J. C.
Beatty, J. G.
Benjamin, R. R.
Cale, C. E.
Creuss, L.
Dowsett, R. E.
Grout, H. A.
Haines, A.
Hart, W. V. B.
Hill, F. W.
Kelton, W. H.
McCankie, R. C.
Porter, E. A.
Rowan, H. R.
Shailer, F.

FELLOWSHIP.

PART I.

Beers, H. S.
Booth, R. I.
Bunyan, A. T.
Henderson, E. C.
Little, R.
Miller, I. A.
Shepherd, C. O.
White, W. C.

PART II.

Birkenshaw, J. H.
Bissel, C. R.
Bowerman, W. G.
Brown, E. G.
Hezlett, E. H.
Holmes, H.
King, E. C. (Mrs.)
McConney, E.
Powell, J. M.
Riley, A. J.
Smith, F. M.
Warters, D. N.

Vol. XXII, Part Two. No. 66

TRANSACTIONS

OCTOBER 27TH AND 28TH, 1921.

Address by the President, William A. Hutcheson.
A Review of Disablement Insurance.

> There is much interest in catching occasional glimpses of a by-gone state of society. They seem to show us, in the expressive language of Scripture, "The rock whence we were hewn, and the hole of the pit whence we were digged."
> —*Hugh Miller.*

A year ago I took occasion to give a sketch of some of the factors in the development of the insurance idea and of some of the events which led up to the institution of life insurance companies as we now know them.

In addressing you today, I shall, first, outline some of the changes that have taken place in the policy contracts issued by American life companies. I shall then direct your attention to one of the most popular, but not universal, features of the present-day policy—reviewing the history of other institutions granting somewhat similar benefits, and shall suggest what may ultimately be some of the future developments along the line of this popular feature.

Early Plans of Insurance.

The earliest policies sold in America were reversionary annuities for widows; this was in pre-revolutionary days, for "The Presbyterian Ministers' Widows Fund" was started in Philadelphia in 1759 with this object in view. Ten years later, at the suggestion of Benjamin Franklin, the Reverend Richard Price, as you know, computed the rates for "The Corporation for the Relief of Widows and Children of the Church of England in America," and the object of this corporation also was to sell reversionary annuities.

Coming to the birth of modern life insurance in America, the original project of the promoters of the Mutual Life of New

York—the first company actively in the field—was to sell such contracts, although, before it actually commenced business, its plans had been changed to cover term and ordinary life insurance only. Incidentally, it may be of interest to you to know that the American Experience Table of Mortality was first used in 1862 by The Mutual Life for reversionary annuity premiums, and that the first such policy issued by it was on the life of the late Sheppard Homans, its then Actuary and our Society's first President.

To return to our subject, however, the first policies issued about three-quarters of a century ago, when scientific life insurance started in America, were term and life policies. Endowment insurance policies followed some years later; perhaps, such policies maturing at advanced ages—issued now where life policies would formerly have been issued—will gradually become the predominant form of life insurance in this country.

Policy Conditions.

To indicate the changed conditions in our policies, we need only compare the old forfeiture of the policy for non-payment of premium with the present liberal provisions for cash, loan, paidup and extended insurance values; the former restrictions as to residence and travel with the present freedom from restrictions; and the deferred distribution of surplus of comparatively recent times with the annual dividends of present-day contracts.

Disability Benefits.

The outstanding feature of the policy issued nowadays, however, is the provision for waiving the premium in the event of total and permanent diability, combined, very often, with an income during such disablement. This benefit is payable in the event of disablement either by accident or by disease, so that we have now entered into a new field for life insurance companies—one in which there are great possibilities for future development. It is appointed that man shall die but once, but it is possible to be disabled by accident or sickness every day of the week. Statistics as to death rates are more or less accurate, so that we can apply the theory of probabilities to life contingencies, but, on the other hand, we have much to learn regarding disablement rates, and doubt may even exist as to the applicability of actuarial science to accident and sickness insurance.

When we come to determine in individual cases, whether or not the contingency insured against has happened, so far as death and

survival—the two basic contingencies in life insurance—are concerned, there can be little doubt except in occasional circumstances, but the question as to whether a policyholder is totally and permanently disabled is frequently a matter of doubt and uncertainty. Doubt may exist as to the disablement being *permanent,* or as to its being *total,* or it may exist as to its being either the one or the other, and a company undertaking this class of business must be prepared to treat its policyholders liberally and give them the benefit of the doubt, especially as to the permanency of the disability, if there be any.

Possible Developments.

A policyholder, having such a contract, is fully protected if he becomes totally and permanently disabled, but there are two other contingencies, one regarding his health, and the other regarding his financial circumstances, which may make it impossible for him to continue payment of premiums on his contract. He may become disabled, although not totally and permanently, and this is a contingency which may ere long be covered by life insurance contracts. In fact, some life companies are already issuing non-cancellable accident and health policies. Or, again, the insured may lose his income through unemployment, and who will be bold enough to say that this contingency may not some day be covered by the life insurance companies in their life contracts? I prefer not to assume the rôle of prophet regarding this last mentioned possibility, and will now take you back to the subject of disability—*i.e.,* sickness and accident—insurance.

Accident and Sickness Insurance.

Such benefits are now being granted by at least three classes of institution. The first in the field were the old British Friendly Societies; they embraced in their membership almost exclusively the laboring classes; *inter alia,* they granted pay for temporary as well as permanent, and for partial as well as total disablement. In passing, it may interest you to know that, in days gone by, "bed-lying pay" was the term given to pay granted during total disablement, whereas "walking pay" designated what we now know as partial disablement pay. Following the Friendly Societies, the British and American accident companies were the next to grant such benefits, and lastly, the American life companies have, in many cases, entered this field in issuing policies with disability benefits.

Friendly societies, as you know, are of great antiquity, and were formed for the purposes of the mutual relief and maintenance of members in sickness, old age and infirmity, and for the relief of the widows and children of deceased members, according to the British Friendly Societies Act of 1793. The bill brought into the House of Commons prior to the passing of this act had extensive tables appended to it, which had been calculated by our old friend, the Reverend Richard Price, at the request of a committee of the House of Commons. It will interest you to know that it is reported that Benjamin Franklin was one of those who sanctioned the bill.

Friendly Societies.

When Dr. Price prepared these sickness tables, no data existed as to sickness rates, and he consequently had to make certain assumptions. The suppositions on which the tables were formed were, 1st, that "in societies consisting of persons under 32 years of age, a 48th part of them will be always in a state of incapacitation by illness and accidents; and therefore entitled to allowances proportioned to their contributions, and, 2nd, that from age 32 to 42 this proportion increases to one-quarter more than a 48th part; from 43 to 51 to one-half more; from 52 to 58 to three-quarters more; and from 59 to 64 to double."

Dr. Price's Sickness Rates.

The first supposition means that the average sickness per annum per member would be 52/48 weeks, *i.e.*, 1.083 weeks for ages under 32; 25 per cent. more or 1.354 weeks for ages 32 to 42, and so on.

He gives rhyme and reason for the suppositions, and many details, all of which can be found in Vol. II of the 7th Edition of Price's "Observations on Reversionary Payments," commencing at page 473.

This Act of 1793 required the registration of Friendly Societies in order that they might obtain legal protection, and a subsequent act of 1829 made it necessary for such societies to make quinquennial returns of the rates of sickness and mortality. The experiences of these Registered Societies have been investigated from time to time. The earliest one, covering the period 1836–1840, was made by F. G. P. Neison, Senior, and he startled the Manchester Unity of Oddfellows out of its security by pointing out that that society was in a deplorable financial condition. This led to the Manchester Unity, first, closely observing and tabulating its own experience,

Various Investigations.

under the able superintendence of its Secretary, Mr. Henry Ratcliffe, second, making periodical valuations of the assets and liabilities of each lodge, and, third, enforcing upon all new members the payment of properly graduated rates of contribution.

There have been three investigations into the experience of the Registered Friendly Societies, and four into that of the Manchester Unity, as well as several others, so that we have a considerable amount of data regarding the disability experience of such societies. The following table shows the periods covered by these investigations, as well as the names of the investigators:

(1) *Registered Friendly Societies of England and Wales.*

	Period
(*a*) F. G. P. Neison, Senior's investigation	1836–1840
(*b*) A. G. Finlaison's investigation	1846–1850
(*c*) W. Sutton's investigation	1876–1880
(2) *Ancient Order of Foresters.*	
F. G. P. Neison, Junior's investigation	1871–1875
(3) *Manchester Unity.*	
(*a*) H. Ratcliffe's investigation	1846–1848
(*b*) H. Ratcliffe's investigation	1856–1860
(*c*) H. Ratcliffe's investigation	1866–1870
(*d*) A. W. Watson's investigation	1893–1897

Highland Society's Investigation.

The earliest investigation into the sickness experience of friendly societies, however, was that made by a committee of the Highland Society of Scotland; it covered various periods from 1750 to 1821 and the results were published in 1824. The rates deduced from this investigation gave far too favorable a view of sickness prevailing in friendly societies, but they were largely used until withdrawn in 1851. Neison, Senior, showed that the rates of mortality were higher in Scotland, but that the rates of sickness were less than those of the 1836–1840 investigation.

The committee in charge of this investigation had a clear idea of the problem it had to solve, for it reported that a committee formed 20 years earlier was conscious of the impossibility of establishing accurate calculations for friendly society sickness until the average rate of sickness among mankind should be ascertained. It is interesting to note that one of the members of this committee was Patrick Cockburn, the first Actuary and Auditor of the Scottish Widows Fund in Edinburgh; it was he who drew up its first

premium rates and who was responsible for its early distributions of surplus. Another matter of interest to some of you is that the calculations in connection with this sickness experience were made by the Governor of George Watson's Hospital in Edinburgh, the predecessor of the school where so many of our actuaries were educated in their youth. Attached to this report, which can be found in our Society's library, is a table showing the sickness in weeks for ages 20 to 70 derived from this experience. No returns were obtained by the Highland Society regarding mortality.

Manchester Unity Investigation.

Coming now to the Manchester Unity 1893–1897 experience, it covers mortality as well as disablement and is by far the most extensive. It covered 800,000 lives, 3,000,000 years of life, and 7,000,000 weeks of sickness. In addition to its being the most modern and extensive, it has, *inter alia*, these advantages: (1) it is classified by groups of occupation, and (2) it shows the disability rates for various periods after disability commences—first three months, second three months, etc. This latter division shows that a very large part of the disablement is of short duration. In stating that this experience had certain advantages, it is well to mention that the various investigations mentioned above had each been divided in several ways, such as by locality, density of population, etc. I shall refer hereafter to the last two Manchester Unity experiences only, as they bring out sufficiently the various points which I wish to emphasize.

What I have to say regarding disablement insurance—by which I mean both accident insurance and sickness insurance—will, I fear, appear very elementary to those of our members who are connected either with friendly societies or with companies doing an accident business, or who have made a study of these forms of insurance in connection with our disability benefit, but there are others to whom the subject is not so familiar, and it is for them that I have brought together what follows.

Now, we must bear in mind that these Manchester Unity experiences do not differentiate between accident and sickness claims; in other words, the disablements there shown arise partly from accidents and partly from sickness, but in what proportions we have no means of knowing. Steps have been taken in subsequent investigations to keep data regarding the two risks separate, and we have some data along this line, covering, unfortunately,

only a few occupations. We must not forget either that these Manchester Unity experiences include partial disablement as well as total disablement, and temporary as well as permanent disablement.

Another fact which has to be remembered is that the friendly societies, generally speaking, cover only the laboring classes, and males only, whereas policyholders in accident and life companies are to a greater extent drawn from the professional, commercial and clerical classes, and from both sexes.

I have brought together in Table A some of the salient points of the Manchester Unity experiences of 1866–1870, and 1893–1897, which have very obvious lessons for us.

In the first place, these tables clearly show that the *rate of disablement* per annum per member increases with the age. I mention this, as accident and sickness policies are still very largely issued at the same rate of premium irrespective of age.

This Table A shows the disablement rate for five-year groups of ages, and it will be seen therefrom that, for the five ages 20 to 24, the average number of weeks' disablement per annum per member for the 1893–1897 experience was 0.9 week; for 30 to 34 it was 1.06 weeks, for 40 to 44 it was 1.58 weeks, for 50 to 54, 2.75 weeks, and for 60 to 64, 6.31 weeks.

Not only does the *rate* of disablement per member exposed increase with the age, but the average number of weeks' disablement-pay drawn also increases with the age. For the five-year groups of ages commencing at 20, 30, 40, 50 and 60, the Manchester Unity 1893–1897 experience shows that the disabled members made claims for 3.67, 4.51, 6.22, 9.31 and 15.84 weeks respectively.

In other words, the probability of a member becoming disabled increases with age, and, the older he is when disabled, the longer it takes him to regain health. The conclusions we actuaries will draw from these facts are that the one-year-term rate should increase with age, and that, if a level premium be charged, reserves must be built up as in the case of life policies.

The above figures are taken from the 1893–1897 experience, but the earlier experiences show the same general results.

When we compare the 1866–1870 mortality and disability experiences with those of 27 years later, 1893–1897, we find that the death rate is less in the later experience up to about age 60, the

reverse being the case at older ages, whereas the disability rate is greater for all ages in the later experience. But while the disability rate is greater in the later experience, the average periods during which such disability claims are payable are shorter in the 1893–1897 experience than in the 1866–1870 experience, and the financial strain which disablement puts upon a society depends, of course, not only upon the *number* of members making claims but also upon the *period* during which such payment continues to be made.

TABLE A.

M. U. General Experiences.

Age Group.*	Disablement Rate per Member per Annum in Weeks.		Average Number of Weeks of Disablement Claim to Every Member Disabled During a Year.		Death Rate per 100 Members.	
	1866–70	*1893–97*	*1866–70*	*1893–97*	*1866–70*	*1893–97*
20–24	0.75	0.90	3.69	3.67	0.64	0.37
30–34	0.93	1.06	4.62	4.51	0.82	0.55
40–44	1.26	1.58	6.42	6.22	1.26	0.95
50–54	2.22	2.75	11.26	9.31	1.91	1.69
60–64	4.72	6.31	24.26	15.84	3.54	3.56
70–74	12.06	17.40	60.47	28.71	7.81	8.09
80–84	20.59	32.27		37.90	11.88	17.66

* Intervening five-year age groups omitted to shorten table.

Decreasing Mortality, Increasing Disablement.

An examination of all four Manchester Unity experiences shows that the disablement rates are constantly rising, whereas the mortality rates, except at the older ages, are declining. In commenting on this situation, Sir Alfred Watson, the President of the Institute of Actuaries in London, stated that this affected the societies unfavorably "in two directions; not only is the sickness, per member, at each period of life heavier than was formerly the case, but a greater proportion of members than formerly now survive into old age, the period of life at which sickness is at its maximum intensity."

This decreasing mortality, accompanied by increasing disability, is being experienced very generally in America as well as in England. It indicates that the operation of the law of the survival of the fittest has been impeded, with results unfavorable to the health and vigor of adult life. Probably this old law is not applicable in these days of modern civilization!

Notwithstanding the experience of the Manchester Unity, is it possible that the actual disability rate is not increasing? Perhaps the experience of the Manchester Unity only shows that people are taking better care of themselves; that they "lay up" for a few days when they feel indisposed, thus increasing the disability rate but adding to the average longevity of the group—on the principle that "a stitch in time saves nine."

I would suggest to our members that they investigate the question as to "Whether, with increase of average length of life, there has been improved health or otherwise." The Manchester Unity figures would indicate otherwise. Such a subject would be an appropriate topic for a paper for our Society. What, if any, influence the various private and institutional endeavors towards accident prevention and prolongation of life have had on the results pointed out, would be an interesting line of investigation.

Disablement by Occupations.

So far, the figures I have given regarding the Manchester Unity experience are for all groups of occupations combined, but, in addition to the general sickness experience covering all occupations, nine occupational groups (indicated by the letters A, B, C, etc.) of the Manchester Unity experience of 1893–1897 were analyzed as follows:

A. Agriculture
B. Outdoor building trades, including casual or unskilled outdoor labor
C. Railway service
D. Seafaring, fishing, etc.
E. Quarry workers
F. Iron, steel, chemical, glass workers
G. Mining occupations, chiefly underground
H. Remaining occupations (Rural)
J. " " (Urban)

and then these nine groups were combined into four smaller groups. The following table shows the occupational groups and the proportion of the Society's whole experience included in each of these four new groupings:

	Per Cent.
A, H and J	78.5
B, C and D	11.2
E and F	4.5
G	5.8
Whole Society	100.0

One of the most dangerous occupations from the friendly society's point of view is that of the agricultural laborer, because, while the mortality is extremely light throughout life, rates of continued sickness are extraordinarily heavy at advanced ages.

As would be expected, these various occupational groupings show not only different *disablement rates* but also different average *periods of disablement.* This is exhibited in the following Table B:

TABLE B.

M. U. 1893–1897.

(1) Number of members disabled in a year amongst 100 members exposed to risk.

(2) Average number of weeks of disablement claim to every member disabled during a year.

Age Group.	Occupational Group.									
	A H J.		B C D.		E F.		G.		Whole Society.	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
20–24	22.45	3.66	26.53	3.59	32.86	3.64	38.15	3.83	24.45	3.67
30–34	21.51	4.49	26.35	4.45	32.34	4.51	39.09	4.67	23.62	4.51
40–44	23.27	6.21	28.38	6.14	34.64	6.13	41.67	6.47	25.48	6.22
50–54	27.35	9.28	33.58	9.36	38.09	8.30	47.46	10.21	29.51	9.31
60–64	37.56	15.57	44.62	16.06	51.51	16.08	59.34	18.42	39.81	15.84
70–74	59.02	28.25	67.22	29.62	70.78	31.86	77.82	34.12	60.60	28.71
80–84	84.28	37.70	87.10	38.94	99.49	38.82	98.02	40.30	85.15	37.90

The more laborious occupations naturally show the greater numbers disabled, but, unfortunately, no separation was possible to indicate what proportion of those disabled was due to accident and what to sickness.

So much, then, for the Manchester Unity experience of 1893–1897, which was compiled by Sir Alfred Watson.

In an extremely interesting paper read before the Institute of Actuaries in London in April, 1910, this same gentleman stated that recently some of the Manchester Unity friendly societies had

separated their sickness from their accident claims, and he gave the results of such separations for various groups showing occupational risks. I shall refer only to one case cited by him; it covers the experience of a railway society for the five years 1904 to 1908 inclusive, and the following Table C gives the particulars regarding this society in which the accident allowance had for many years been a separate benefit, so that there can be little doubt as to the accuracy of the separation. The experience covers 40,201 years at risk, 53,813 actual weeks of sick claim and 18,074 actual weeks of accident claim, a total of 71,887 weeks in all, whereas the expected weeks of claim by the Manchester Unity (A H J group) was 57,458.

TABLE C.

RAILWAY EXPERIENCE 1904–08.

Age Group.	Proportion of Members Claiming.		Average Claim for Sick-Pay.		Average Claim for Accident-Pay.	
	Sick-Pay.	Accident-Pay.	All Members.	Sick Members Only.	All Members.	Disabled Members Only.
			Weeks	Weeks	Weeks	Weeks
20–24	.288	.126	.848	2.940	.384	3.042
30–34	.277	.114	1.071	3.862	.450	3.952
40–44	.257	.082	1.172	4.567	.374	4.546
50–54	.293	.083	2.325	7.931	.532	6.377

It will be seen from the first column of this table that the proportion of members in this railway society claiming sick-pay did not vary very greatly with the age, and that the proportion of those claiming accident-pay decreased with age, possibly because the older members were engaged in less hazardous work, and probably because of increasing experience with increasing age. On the other hand, it is seen that the average duration for sick-pay and also the average duration for accident-pay, per member disabled, increased with the age. Even in such a hazardous occupation as railroading, the accident-pay cost the society much less than the sick-pay. As evidence of the greater cost of sick-pay as compared with accident-pay, I may state that I have seen the rates of an accident company which charges about eight times as much for the risk of sickness as it does for the risk of accident—the rates being for non-hazardous occupations at age 30.

When experiences such as that given in Table C have been investigated for various occupations, a great step will have been

made; in fact, the cost of the sick benefit and the cost of the accident benefit will be within our reach.

Before leaving friendly societies, I shall call your attention to the fact that in the early days of life insurance in Great Britain, life companies could enroll under the acts relating to friendly societies, and by doing so obtained certain advantages—exemption from stamp duties, freedom from certain legal requirements in payment of sum insured, etc.—which were denied life companies not so enrolled. One company which took advantage of this privilege was the Clergy Mutual Assurance Society, which was founded in 1829. In early days its life policies covered sickness insurance as well as life insurance, so that the combination of life insurance and sickness insurance is not new.

Accident Insurance in Britain.

I shall now leave the field of friendly societies and endeavor to point out some of the incidents which led up to the institution of accident insurance, some of the steps in its development, and some of its difficulties.

Before doing so, however, it is well to state that accident insurance is intended to indemnify the insured from financial loss which he suffers when he is injured to such an extent that he is prevented from following his usual occupation or pursuits. It is not meant that the mere fact of receiving injury should entitle the insured to compensation.

The institution of accident insurance was due to the introduction of steam locomotion nearly 100 years ago, and as life insurance was an outgrowth of marine insurance, ships and trains are responsible for the birth of life and accident insurance, respectively.

Accident insurance had its inception in Great Britain, and it came about in this way: In the "eighteen forties" steam railroads were new and the modern system of block signalling was unknown. A day train was given so many hours' start before the succeeding train was dispatched, while at night the rear guard dropped flares to warn the on-coming train of the danger ahead. In 1848 the introduction of express trains in Britain caused great disorganization of traffic, which resulted in many accidents, and accident insurance was instituted to meet this situation. The Railway Passengers Assurance Company started business in 1849, and opened its campaign by issuing "tickets" to the traveling

public, similar to railroad tickets but in effect accident policies. From this small commencement the great business of accident insurance and of sickness insurance has developed.

In the early days these accident policies provided for payment of what was termed the "capital sum" in the event of a fatal accident from railroad traffic. The next development was to provide for payment of a like amount in the event of a fatal accident arising from any cause. At first, non-fatal accidents were not covered by these accident policies.

In covering, first, the *Travel* Double Indemnity Benefit, and then the *General* Double Indemnity Benefit in their life policies, the American life companies have been following, consciously or unconsciously, the precedent set them by the British accident companies.

The next step in the evolution of the accident policy was the inclusion of benefits for permanent total disablement and for payment of a portion of the death benefit in case of permanent partial disablement.

Later on, double benefits for travel accidents were included in the accident policies, and, when all feasible benefits for accidents had been covered by such contracts, the next advance made in the policy was to provide for "limited sickness" insurance covering specific diseases. In addition, the policies provided for annuities payable in the event of blindness or paralysis caused by accident. Finally, the policy was made to include all-accident and all-sickness benefits with capital benefits at death.

It should be stated that these accident policies were all on the annual renewable term plan, but that the company had the right either to refuse to renew them, or to cancel them at will,—very proper privileges when there were practically no statistics available for accident or sickness rates.

Treating the development chronologically, in 1850 a £1 annual premium at all ages secured £1,000 at death by accident, and an additional £2.10/ per annum purchased an additional benefit of £5 a week during temporary total disablement with an allowance of £10 for medical services. Observe the £1 per £1,000—the same charge now made by several American companies for the General Double Indemnity Benefit in their life contracts. (See *T. A. S. A.*, XIX, 79.)

In 1855, a premium of £3 gave £1,000 at death and £6 a week

for temporary total disablement up to 52 weeks. It was found that the payment of the £10 for medical services did not tend to hasten the insured's recovery, and the addition of £1 a week to the allowance was substituted therefor.

In 1862, so many claims were being made on the accident companies for trivial accidents that extra premiums were charged and, in addition, the weekly allowance was cut down to 26 weeks from 52 weeks.

In 1866, provisions for payment of specific sums in respect of certain stated injuries were added.

In 1869, a 10 per cent. reduction of premium after payment of five years' premiums was instituted. Some companies gave each 6th year free instead of reducing each premium 10 per cent.

In 1881, a provision for paying the capital sum for the loss of two limbs or two eyes was added to the contract, with the additional provision of 50 per cent. of the capital sum for the loss of one limb or one eye.

It is interesting to note that these payments of portions of the death benefit in case of permanent partial disablement were in line with the compensation which the Republic of the United Netherlands agreed to award to its soldiers in the war with England, which started in 1665. These rates of compensation provided for payment of Fcs. 1,500 in the event of the loss of both eyes or both arms; Fcs. 1,200 in the event of the loss of both hands; Fcs. 700 in the event of the loss of both legs, Fcs. 450 in the event of the loss of both feet, or a right arm, and smaller sums in the event of the loss of a left arm, or one eye, hand, leg or foot.

In 1885, a company was formed in Britain for extending the privilege of permanent sickness insurance to the business and professional classes.

Accident Policy also Covers Sickness Insurance.

In 1893, the accident policy covered, for the first time, certain zymotic diseases, such as typhoid fever, typhus fever, scarlet fever and smallpox, and an extra premium of one-tenth of one per cent. of the capital sum was charged therefor. Following this, almost every year additional diseases were added to those covered by the policies, until in 1906 the all-sickness and all-accident policy was issued. This policy, however, did not prove profitable to the companies and has been gradually withdrawn or issued only in special cases.

In Britain the ordinary accident-only policy, issued prior to 1890, called for an annual premium of £4, £5, or £6 according to whether the insured's occupation fell within class I, II or III, based upon the assumed hazard; in other words, the premium in class II was 25 per cent. greater than in class I, and the premium in class III was 50 per cent. greater than in class I. This policy insured a capital sum of £1,000 payable in the event of death by accident or for the loss of two limbs or two eyes; £500 for the loss of one limb or one eye, and £6 a week for 26 weeks of temporary total disablement, or £1.10/ a week for temporary partial disablement. When the policy was first made to cover all sicknesses as well as disablement by accident, an additional premium of £6 was added irrespective of age or occupation. In view of what I have already pointed out regarding the relative cost of sickness and accident, it is interesting to note that in making the same charge of £6 for the sickness benefit for those in classes I, II and III, it was then apparently assumed that the cost of the sickness benefit was 150 per cent., 120 per cent. or 100 per cent.—for classes I, II and III respectively—of the cost of the accident benefit, and that it did not vary with the occupation or with the age.

For the last quarter of a century, the British companies have graduated the rates according to the age and occupation. The contracts issued by the different companies are, of course, not uniform; it is usual, however, that the benefit payable in the event of disablement shall not commence until the lapse of some period and that the amount payable shall be reduced periodically, say, after the first three months or six months.

It will be seen that *age* has not played a very important part in the premiums of these accident companies. In life insurance, from force of habit perhaps, we look upon *age* as the controlling factor in our premiums, whereas, in accident and sickness insurance, to the factor of age must be added certainly the factor of *occupation* and probably that of *residence*.

Early American Sickness Insurance.

In the late "forties," several companies were formed on the American continent to write health policies. They flourished for a short while, but then expired without leaving either statistics as to their sickness experiences or records as to the causes of their demise. Those of you who are interested in these early American endeavors to write sickness insurance will find

much of interest in the late H. J. Messenger's paper, entitled "Health Insurance in the United States," presented to the Fourth International Congress of Actuaries, held in New York in 1903.

In the presence of so many distinguished actuaries connected with companies writing accident insurance, it would be out of place to do more than make a short reference to accident insurance in America. But for the benefit of the other members of our Society, I wish to say something regarding its commencement. Before doing so, however, I must repeat what I have already said, namely, that the Railway Passengers Assurance Company of London was first in the field in accident business in England, and that it sold "tickets" at the railway stations insuring the purchaser in a certain sum in the event of his meeting with a fatal accident while on his railway journey. The idea that a similar class of business might be transacted in America occurred to the late James G. Batterson, the first President of the Travelers, when he purchased one of these tickets while traveling in England in 1859. In 1863, the Connecticut legislature permitted him to carry out his plan, and the Travelers of Hartford was soon in the field and was the first company to write accident insurance in America.

Accident Insurance in America.

The evolution of the accident policy in America has been along lines similar to those I have already sketched for the British contract—both as to accident and as to sickness benefits. The contract has been of the one-year-term cancellable form, with sickness benefits limited, I am told, to about one year after disablement. The principal causes of cancellation have been misstatements in the original application, impaired physical condition, material reduction in earnings, repeated claims for recurrent types of disease and unsatisfactory moral hazard.

In 1908, the late H. J. Messenger furnished the Society (*T. A. S. A.*, Vol. X, 371) with some very interesting details of the Travelers' sickness experience, but it must be remembered that they were one-year-term cancellable contracts, with benefits limited to a specific number of weeks after disablement. On this account, they, and similar experiences, cannot very well be made use of in connection with rates for contracts which are not cancellable and which provide for benefits continuing throughout disablement.

Although they have no bearing on the subject under consideration, it may interest you to know that the President of the Travelers, some 10 years ago, stated about 26 per cent. of his company's accident claims of all sorts happened at home, about 18 per cent. to pedestrians, about 11 per cent. were due to automobiles, about 11 per cent. occurred during recreation, in about 10 per cent. of the cases horses and vehicles were responsible for the accident, about 7 per cent. were due to street car travel, while railroad travel was responsible for less than 4½ per cent. of the total accidents, and so on. The original object of the company, at its formation, was to cover the railroad travel risk, so these figures show how relatively insignificant such accidents have now become.

To return, however, to our subject, the fact remains that we have no American statistics covering accident and sickness insurance, and we have to fall back on those either of the American fraternal orders or of the British Friendly Societies if we wish to grant what I might term an ideal accident and sickness contract—ideal from the insured's point of view—*i.e.*, one providing full and adequate coverage throughout life. In such a contract the benefits should *not* be limited to a specified number of weeks but should continue during the full period of disablement; these benefits should perhaps commence on the first day of disablement; the contract should be permanent, *i.e.*, it should not be cancellable; finally, it should provide for surrender values.

Ideal Accident and Sickness Contract.

Assuming that such a contract could only be issued subject to satisfactory evidence of insurability, could such a contract be safely issued? and if not, what limitations should be put on it? Fortunately, the question of the issuance of non-cancellable disability policies has recently been before the Casualty Actuarial Society and the Bureau of Personal Accident and Health Underwriters. Towards the end of 1920, the Bureau appointed an actuarial sub-committee of five, consisting of four members of our Society—Messrs. Flynn (Chairman), Cammack, Davis and Laird—and an officer of a casualty company, to make recommendations regarding net premiums and reserves. Other members of our Society, I understand, joined in the deliberations of this committee,

Non-Cancellable Disability Insurance.

and, largely as an outcome of these deliberations, two of our members presented excellent papers on "Non-cancellable Accident and Health Insurance" at the May 1921 meeting of the Casualty Actuarial Society—Mr. Cammack, on "Premiums and Reserves," and Mr. Laird, on the "Underwriting Problems from an Actuarial Standpoint." In his paper, Mr. Cammack pointed out the unsuitability of basing premiums for non-cancellable insurance on the experience of American companies under cancellable contracts, and suggested that the Manchester Unity (A H J) experience, modified in certain respects, be used, until reliable experience of our own was available. The net rates he gave in this paper were recommended to the Bureau of Personal Accident and Health Underwriters in a joint report of the Actuarial Committee and of the Underwriting Committee of the Bureau, and were adopted by the Bureau in June, 1921, a minority report dissenting therefrom having been submitted at the same time by the above referred to officer of the casualty company. This joint report recommended several limitations on the issuance of such contracts, which may be summed up as follows:

1. Limits of age at issue—21 to 55—and to males only.
2. No benefits if disablement occur after age 60.
3. No benefits except for total disability due to accidental injuries or sickness.
4. No benefits for the first two weeks of disability (but 4 weeks' or 3 months' waiting period optional).
5. No benefits at death, nor for specific losses (such as limbs, sight), nor for medical or surgical attendance, etc.

These restrictions make the coverage fall somewhat short of what the public will ultimately want, but they seem wise in view of the inadequacy of American experience under such contracts.

Selection for Accident and Sickness Insurance.

The fraternal spirit has much to do with the admission of members to the British Friendly Societies, and "selection," notwithstanding the medical evidence of good health required on admission, is much less stringent than that required by a life company. On the other hand, the moral hazard is smaller in a friendly society than in a life company, because malingering in these societies is kept at a minimum, due in part to the esprit de corps of its members, and

in part to their system of lodge visitors. A "lodge," "court," "tent" or "division," or what not, generally consists of not more than 100 members and each member of a lodge is responsible for his share of any sickness-pay granted a fellow lodge member, whereas, in a life company, the total cost of sickness-pay would be spread over the whole membership. It must not be forgotten, either, that the members of friendly societies come principally from the agricultural and industrial classes, whereas life policy-holders generally belong, in addition to these two classes, to the commercial, clerical and professional classes.

These are some of the facts which must be considered in determining the suitability of the Manchester Unity (A H J) rates for non-cancellable contracts.

There are many ills to which the flesh is heir which tend to cause disablement, but which do not tend to shorten life; certain occupations, and residence in certain localities, have similar tendencies. So that selection for accident and sickness insurance is a different matter from selection for life insurance.

In selecting for life insurance, the question is "When will he die?" Of course, we cannot answer this question, but we ask ourselves: "Is he up to our standard? Or to what extent is he substandard?" And we have statistics to guide us in this. In accident and health insurance, the problem is not "When will he die?" but "Will he become disabled? If so, when?" "From what cause will he become disabled?" "How long will he stay disabled?" and so on. In the case of applicants for life insurance, we endeavor to select those who show no factors likely to unduly shorten life; whereas, in the other case, selection must be of those not showing over-average tendencies to disablement due either to present conditions, or to adverse personal or family history, or to environment, and statistics on these points are sadly lacking.

In selecting for accident and sickness insurance, therefore, the medical examiner must pay special attention to the applicant's personal history of accident or disease to enable him to form an opinion as to the applicant's tendency to any form of complaint likely to lay him up. To illustrate, tuberculosis and insanity are two of the principal causes of disability under total and permanent disability clauses in life policies, so that great care must be

exercised when there is any tubercular tendency, any history of nervous breakdown, or any family history of tuberculosis or insanity.

Then as to the moral hazard, it is impossible for a policyholder to simulate death, but comparatively easy, in many cases, for him to malinger, and there is a great inducement to do so if he benefits thereby. It is obvious, therefore, that the amount of the applicant's average income should considerably exceed the amount of disablement allowance insured under any contract. The permanency of the occupation must be considered, and those in certain speculative and hazardous occupations, and perhaps those of no occupation, should be excluded.

Permanent Disability Benefit.

I have now come to the end of my review of the British Friendly Societies and of the British and American accident and sickness companies. I have burdened you with these details because I feel that they may be of some help to our younger members as an index to some existing publications, and in giving them a background for their further study of the Disability Benefits now so generally granted by American life companies.

Our *Transactions* contain many excellent papers on Permanent Disability Benefits. Mr. C. W. Jackson blazed the trail with his paper in May, 1908 (X, 490) and almost every number of our *Transactions* issued since then has contained some paper on this subject. The various members who have contributed papers are Messrs. S. H. Pipe (XI, 172, XIII, 20), F. B. Mead (XI, 304, XII, 75), Arthur Hunter (XII, 44, XIX, 219), E. B. Fackler (XII, 241), J. F. Little (XIV, 55), E. B. Morris (XV, 98), Mervyn Davis (XVII, 211), M. M. Dawson (XVII, 274) and J. S. Elston (XXI, 134). These papers have already been printed in our *Transactions*, and Mr. J. S. Thompson's paper will appear in the belated issue for the May, 1921, meeting; Mr. Arthur Hunter, as you know, is presenting another paper today, and the issue of our *Transactions* covering this meeting will contain a paper by Mr. M. M. Dawson. It will thus be seen that this subject of total permanent disability benefits has been considered by our members as a very live one for the last dozen years.

The gradual incorporation during recent years of clauses in the companies' policies covering these benefits is one of the out-

standing features of the life insurance business of the present day. The benefits heretofore granted have generally been for total and permanent disability only, but some companies have recently defined permanent disability as disability which has lasted but a few months, while others now issue non-cancellable accident policies providing for allowances for temporary partial disablement. It therefore seems more than likely that before long the life companies will be incorporating all such benefits in their insurance contracts.

Over-Insurance.

One of the difficulties which the life companies have to face in guaranteeing an income in the event of disability lies in the fact that a policyholder can take individual policies from various companies and so insure an aggregate disability income which, to put it mildly, is no deterrent on malingering, and some method of preventing this must be devised.

A statement in the application as to permanent disability income covered by existing policies might help, and an interchange of information between the various companies would be a further protection, but, if these plans failed, it may be necessary to include a provision in each company's policy to the effect that, in the event of disablement, if the insured is covered by several policies, each company will pay only such proportion of the income insured by its policy as its policy bears to the aggregate disability income. Clauses of this nature are already incorporated in accident policies.

At the present time, the disability allowances which we are granting are generally either 10 per cent. per annum, or one per cent. per month of the sum insured. In a policy granting life insurance and also disablement benefits, each death relieves the company financially from the payment of future disability allowances, so that it is not always a disadvantage to a company, once a policyholder becomes disabled, for such death to occur; it depends upon the relative value of the insurance and the sickness, and the present disablement allowances of 10 per cent. or 12 per cent. per annum of the sum insured may not be the most desirable allowances in view of this fact.

The situation, as I see it, however, is that the present permanent total disablement allowances may very possibly be extended to cover partial and temporary disablement.

To summarize, the British Friendly Societies were first in the field in the payment of sickness and accident benefits. Their membership, coming generally from the agricultural and industrial classes, differs from that of a life insurance company. Their experiences do not differentiate between sickness and accident rates, and they embrace partial and temporary, as well as total and permanent, disablement. In addition, their disablement rates vary in the case of individual societies according to the allowances granted under their rules; further, disablement experiences show that the risk is increasing.

Conclusion.

These Friendly Societies were followed by accident companies —both here and in Great Britain—but these accident contracts have principally been of the one-year-term cancellable nature, so that experiences under such contracts are by no means satisfactory bases for the calculation of life companies' disability benefits.

Finally, the American life companies have recently added the disability feature to their contracts.

The great difficulty we actuaries have to meet in connection with the issuance of sickness and accident benefits is the difficulty first pointed out by the Highland Society in its report of 1824, namely, the absence of statistics of the rates of sickness and accident disablement. Much has been done since then in the way of compiling experiences, but the first two questions we must solve are as to the possibility of constructing generally applicable sickness and accident tables, and as to what modifications should be made therein to cover the varying risks in different occupations. We have seen that, in the Friendly Societies, the rates of disablement have been increasing, age for age, with lapse of time. Another problem which confronts us, therefore, is "To what extent can past experiences be relied upon as a guide in the future?"

In addition to the question of rates, the element of imposition is one which has to be met. This is a most important question when we come to draw up contracts.

Some time, in the not very far future, the various life companies transacting this total disability business will no doubt combine their experiences, but the time for making such a joint investigation is hardly ripe yet, for the companies have been transacting this business only for a very short period on the average. It behooves us, therefore, to study the question, both as to

rates, benefits and restrictions, so that we may be prepared, when occasion arises, to advise our companies as to the conditions on which such business can be safely conducted, if at all, and we will be the better prepared to come to a proper decision in these matters if we have studied the subject carefully and thoroughly. To help us do this, is the object I have had in view in preparing this address; that, and the fact that our By-Laws require the President to address the members at each meeting!

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Ratings for the Principal Impairments.

BY

ARTHUR HUNTER AND DR. OSCAR H. ROGERS.

The great majority of medical impairments occur comparatively infrequently in routine insurance practice. A dozen of these impairments make up nearly 90 per cent. of the substandard cases handled in the course of our daily work. Of these, some have already been discussed in other papers, and the remainder of them are considered in this paper with the object of answering numerous inquiries as to our treatment of the principal medical impairments.

The impairments which present themselves to Medical Directors in the course of their routine work will vary greatly in the different companies, will be distinctly fewer in number in the companies which limit themselves to standard lives, and correspondingly more numerous in companies which do a substandard business. Aside from occupations, the principal impairments met with in the routine of handling our company's substandard business, arranged in the order of their frequency, are as follows:

Heart murmurs,
Overweight,
Albumin in the urine (with or without casts),
Consumptive family history (usually with underweight),
Irregular, intermittent, or rapid pulse,
High blood pressure,
Unsatisfactory habits as to alcohol—past or present,
Syphilis, history of,
Gastric and duodenal ulcers, history of,
Gall stones or biliary colic, history of,
Gravel or renal colic, history of,
Sugar in the urine,
Lung trouble, history of,
Applicant not robust,
Goitre,
Inflammatory rheumatism, history of,
Underweight,

Pleurisy, recent history of,
Asthma,
Middle ear disease.

The first three of them cover nearly one-half of the total, and none of those listed after the first ten occurs in more than 1 per cent. of all substandard cases.

It should be noted that the foregoing list applies to substandard risks. The order of their frequency would have been materially changed had standard risks with minor impairments such as asthma and middle ear disease been included, as some of these occur quite frequently among applicants accepted by our company at the regular rate of premium.

Our medical ratings are expressd in the same manner as that employed in the Medico-Actuarial Mortality Investigation, excepting that, instead of giving the total mortality due to an impairment, only the amount of the excess mortality above the normal is given—thus, + 50 per cent. means a mortality of 150 per cent., + 100 per cent. a mortality of 200 per cent., and so on. The ratings therefore apply to practically any system of selecting risks for insurance. The letters "R. N. A." mean "Risk not Acceptable," and no ratings are given.

These ratings should not be looked upon as final but only as expressing the best information now available on the subjects to which they apply. We have had occasion in the past to make changes in them, and expect to do so in the future as new facts are brought out to render such changes necessary. Ratings which may correctly express present-day experience may be found in the future to be either too lenient or too severe.

Heart Murmurs.

Our ratings on heart murmurs are based upon the same statistics as those employed in our paper entitled "Heart Murmurs—Their Influence on Mortality," supplemented by additional information obtained since that time. We employ them with such variations in individual cases as the circumstances in each case seem to justify. A person with a heart lesion, whose occupation involves considerable physical exertion or mental effort, should obviously receive a rating higher than one whose life is free from business anxiety or physical strain. These adjustments of the ratings ap-

plicable to individual cases the selector must make in such fashion as to secure in the group as a whole the mortality desired by his company. He must not modify *favorably* some of the cases unless he modifies *unfavorably* others of them. The ratings are true only for average cases and not for the most or the least favorable.

These considerations enter to a still greater extent with regard to those risks where there is a *history* of a heart murmur, in which, as will be noticed from an inspection of the schedules, a good deal of leeway is permitted in the standard ratings. By a "history of a heart murmur," we mean: (*a*) a record by our own company; (*b*) a finding by another company; (*c*) a statement by the applicant himself; (*d*) a report from a physician. If two competent examiners, knowing that a heart murmur has been found in the past, fail to find it a year or more after the original record, the history is disregarded, unless there are several records. Of heart murmurs that are found today and are not found next month by equally competent examiners we have no statistical evidence upon which to base an opinion. Such cases are rated conservatively on consultation between members of our Medical Board.

Heart Murmurs.

	Very Best. No Hypertrophy	Average. No Hypertrophy	With Slight Hypertrophy	With Moderate Hypertrophy	With considerable Hypertrophy
Mitral regurgitation....	+ 60	+ 75	+100	+125	R.N.A.
Mitral obstruction.....	+200	R.N.A.	R.N.A.	R.N.A.	"
Aortic regurgitation....	+200	"	"	"	"
Aortic obstruction.....	+ 75	+100	+125	+150	"

	Up to age 35	Age 36 to 45	Age 46 and over
Functional	+ 10	+ 30	+ 50

History of Heart Murmur.

Functional—Disregard if two examiners report no murmur.	
Mitral regurgitation.....	+ 20 to + 40
Aortic obstruction.....	+ 35 to + 50
Aortic regurgitation.....	+ 50 up
Mitral obstruction.....	+ 50 up
Double murmurs.....	+ 50 up

When there is a history of acute articular rheumatism or where

the pulse is rapid, irregular or intermittent, an addition is made to the sum of the ratings for the two impairments. It may be recalled that the experience of the New York Life was unfavorable in these cases.

Overweight.

Our ratings for overweight were given in our paper on the "Numerical Method of Determining the Value of Risks for Insurance," published in 1919. As to these overweight risks it may be well to repeat that the ratings apply to average risks and not necessarily to any given risk. Any considerable departure from the schedule rating should rest, however, on clear proof that the individual case under consideration differs decidedly from the average of its class. Overweight risks are usually presented in most favorable terms. Whatever the real facts may be the overweight is almost invariably a well-marked family characteristic. Rarely are they described as flabby or obese. On the contrary, they are said to be remarkably vigorous and active persons, large-boned and heavily muscled. Yet it is with just such material that the life companies were dealing when they experienced the mortalities disclosed in the Medico-Actuarial Investigation.

Albuminuria.

In a paper on "The Effect of Glycosuria and of Albuminuria on Mortality," published in 1917, we gave the experience of our company with albuminuria. Since that time, we have had an opportunity to study additional material from another source.

The significance of albuminuria depends upon several factors, the amount of it found and whether it is constant, intermittent or occasional. A company which limits its acceptance of cases of albuminuria to risks in which only faint traces are found occasionally, would naturally have a better mortality than that experienced by a company which freely accepts on substandard plans cases showing a moderate amount of albumin constantly. It is essential therefore in comparing the experience of different companies to know the types of albuminuria dealt with in each of them. These shade insensibly from those in which it is only rarely found in traces to those in which it is found constantly in large amounts. We distinguish between them as follows:

Accidental—if found once in several tests.

Intermittent—if found in two out of three or four tests.

Constant—if found in two out of two, or three out of three or four tests.

In determining the amount of albuminuria, the standards recommended by the Association of Life Insurance Medical Directors are followed.

Our schedule of ratings is as follows:

Albuminuria.

Accidental 0

Intermittent.

	Ages.		
	Under 30.	30–45.	Over 45.
Faint trace	0	+ 10	+ 10
Trace	0	+ 10	+ 20
Moderate	+ 10	+ 20	+ 30
Large amount	+ 50 up	+ 75 up	+100 up
Constant.			
Faint trace	+ 10	+ 20	+ 25
Trace	+ 25	+ 35	+ 50
Moderate	+ 40	+ 50	+ 75
Large amount	+100 up	+125 up	+100 up

With respect to a history of albuminuria, our practice is to impose an additional rating of from 10 to 30 points, depending upon the conditions, the age of the applicant and whether the history is recent or remote. We usually disregard a history of more than two years standing, provided the record has been entirely clean in the meantime and several intervening examinations have shown no albumin.

Consumption in the Family History.

We have no reason to change in any respect the ratings for this impairment, as published in October, 1919, in a paper on "Numerical Method of Determining the Value of Risks for Insurance."

Rapid Pulse.

The principal source of our information on this subject is the Medico-Actuarial Mortality Investigation, supplemented by our own experience.

The following ratings are employed:

Rapid Pulse.

Rate of Pulse.	Additional Mortality Expected.
90–100	+ 50 to + 75
100–110	+ 75 to + 125

A rapid pulse appears to be equally significant at all ages and foreshadows disease of the heart or blood vessels, or indicates tubercular disease.

Slow Pulse.

As was shown in the Specialized Mortality Investigation, a slow pulse is an advantage rather than a disadvantage. Where the pulse rate is from 55 to 65, we usually allow a credit of 10 points; if the pulse rate is below 55, it is a cause for suspicion, perhaps of fatty heart, and an attempt is made to investigate the condition of the heart muscle.

Irregular or Intermittent Pulse.

Our experience among lives with a persistently irregular or intermittent pulse shows a distinctly high mortality. The material available was not sufficiently extensive to enable us to differentiate between the intermittent and the irregular pulse, so that we still treat them as if they were of the same significance. The element of age appears to be of importance, as well as the degree of irregularity or of intermittence. Our schedule of rates is as follows:

Irregular or Intermittent.

	Ages at Entry.			
	15–30.	30–45.	46–55.	56–up.
5 or less per minute	+20	+40	+ 60	+ 80
Over 5 per minute	+30	+55	+ 80	+100
Irregular and intermittent	+40	+75	+100	+100

It will be recalled that the results of the Medico-Actuarial Investigation were favorable in these conditions, but the Committee very properly pointed out that the low mortality was probably due to the inclusion in the group of many cases in which the condition was temporary or caused by the excitement of the examination. Our ratings apply to cases which, on the whole, have been sufficiently studied to indicate that the condition is not temporary.

High Blood Pressure.

The Joint Committee of the Actuarial Society and the Medical Directors' Association recently investigated the question whether there was available in the records of the larger companies material sufficient for an investigation into the effect of blood pressure on longevity. It was found that a considerable volume of reliable material could be obtained on systolic blood pressure, but that the period of its exposure was quite short. Moreover the practice of taking the diastolic pressure has only become general within the last few years. It was therefore decided to delay an investigation into the effect of blood pressure until the experience had more fully ripened. The experience of our own company is necessarily limited and especially so when divided according to age and to degree of departure from the average systolic and diastolic pressures. The testimony of rejected lives presented from time to time to the Medical Directors' Association by Dr. Fisher and the opinions of a number of clinical experts have also been called upon to add to our knowledge. The whole subject is still in need of a thorough investigation and it is hoped that in a few years a co-operative study may be made of it to the lasting benefit not only of life insurance but of the science of medicine as well. Meanwhile, in our own practice, we have assumed that the *average* blood pressure is probably the *normal* blood pressure; that a departure of as much as 15 per cent. either above or below the average systolic pressure may be within physiological limits, and that, outside of those limits, we probably come into the field of the pathological, at any rate on the high blood pressure side of the average.

The following table gives the average blood pressure at quinquennial ages and the probable limits beyond which the systolic pressure may be looked upon as pathological:

Men.

Age at Entry.	Assumed Normal Limits.		
	Low.	Average.	High.
20	100 mm.	120 mm.	137 mm.
25	102	122	138
30	103	123	140
35	104	124	142
40	106	126	144
45	108	128	146
50	110	130	148
55	112	132	151
60	115	135	154

The systolic blood pressure of women is slightly lower than that of men at the younger ages, but is about the same as that of men at the older ages.

A diastolic pressure is considered normal if it is from 25 mm. to 50 mm. below the systolic.

The schedule of ratings in use by us, which is necessarily a tentative one, is as follows:

Systolic Blood Pressure.

Age at Entry.	Record in Millimeters.									
	135	140	145	150	155	160	165	170	175	180
	Mortality Ratings.									
20	+10	+20	+30	+45	+65	+90	+115	R.N.A.	R.N.A.	R.N.A.
25	+ 5	+15	+25	+35	+50	+75	+100	"	"	"
30	0	+10	+20	+30	+45	+65	+ 90	+125	"	"
35	....	+ 5	+15	+25	+40	+60	+ 80	+110	"	"
40	....	....	+10	+20	+35	+50	+ 70	+100	"	"
45	....	....	+ 5	+15	+30	+45	+ 65	+ 90	+130	"
50	....	....	....	+10	+25	+40	+ 60	+ 80	+115	"
55	....	....	....	+ 5	+20	+35	+ 55	+ 70	+100	"
60	....	....	....	+ 5	+15	+30	+ 50	+ 65	+ 90	+125

It will be noticed in the foregoing table that the company does not look with favor upon blood pressure near the upper limits of the "normal" and employs a slight rating to express that disfavor. It will also be seen that it does not accept risks in which the extra mortality is above 130 per cent., i.e., a mortality of 230 per cent., while in certain other impairments risks are accepted whose valuation is considerably higher. Our reason for making this distinction is that we do not feel sufficiently confident of our standards to warrant us in advising the company to assume risks on these lives at high ratings. This is true also with respect to large amounts of insurance. Indeed it is our practice to accept risks with unusual care and for only small amounts of insurance in impairments regarding which the underlying data are scanty and with freedom if the statistical basis of our valuation is considerable.

Low Blood Pressure.

The only experience that has come to our notice on this subject is that of the Northwestern Mutual, which indicates that, in cases accepted by that company as standard risks, the mortality has been satisfactory among persons with a low systolic pressure.

Our practice has been to add a very slight rating if the *systolic* blood pressure is 10 mm. below the low limit in our table of normal limits and from + 20 to + 30 in cases in which the blood pressure is more than 10 mm. and less than 20 mm. below the low limit. Where the blood pressure is more than 20 mm. below the "low" line, a substantial rating is applied or the case is declined. In all cases of markedly low blood pressure, an effort is made to ascertain the cause—whether abuse of tobacco, use of drugs, a tubercular tendency, lack of vitality or the like.

Habits in the Use of Alcohol.

The applicants rated up by us for a record of past or present abuse of alcohol represent 5 per cent. only of all persons treated as underaverage risks, excluding those in occupations involving hazard. Nevertheless, they cause us far more trouble than many large classes, as there is no one subject about which the opinions of medical directors differ so greatly as about the treatment of persons whose past or present habits are questionable. Any attempt to classify them is likely to be more or less unsuccessful. Our standards are based on the results of the Medico-Actuarial Mortality Investigation, together with an extensive experience of our own. Great care is necessary in the acceptance of these risks as the anti-selection is likely to be severe. The applicants know their own habits best, and are therefore better able than the insurance company to judge whether the policy offered is to their own advantage or not.

Our standards, which follow, show that the Medical Board is allowed considerable latitude in rating these cases:

Steady Free User.

Steady, free user, never intoxicated	+ 50 to + 100
History of, within 2 years	+ 40 to + 80
History of, 3 to 5 years	+ 30 to + 60
History of, 6 to 10 years	+ 20 to + 40
History of, over 10 years	+ 10 to + 30

Occasional Excess, Still Continuing.

(*a*) Occasional excess for day or evening only, not oftener than six times a year	+ 50 to + 100
(*b*) More frequent, say once a month	+ 75 to + 150
(*c*) More frequently, say once a week	R.N.A.
(*d*) Occasional excess lasting for two or more days but not oftener than three times yearly	+ 150 up
(*e*) More than above	R.N.A.

Occasional Excess, History of.

	Within 2 Yrs.	3 to 5 Yrs.	6 to 10 Yrs.	Over 10 Yrs.
(*a*)	+ 40 to + 80	+ 30 to + 60	+ 20 to + 40	+ 10 to + 20
(*b*)	+ 60 to + 120	+ 45 to + 90	+ 30 to + 60	+ 15 to + 30
(*c*)	+ 100 to + 200	+ 75 to + 150	+ 50 to + 100	+ 25 to + 50
(*d*)	+ 100 to + 200	+ 75 to + 150	+ 50 to + 100	+ 25 to + 50
(*e*)	R.N.A.	+ 100 to + 200	+ 75 to + 150	+ 25 to + 100

The lower of the two ratings in each class applies to persons who are now total abstainers and the higher to those who still use alcoholic beverages moderately.

A person who has taken a "cure" for alcoholic habits is treated the same as if he had not taken the cure but had given a history of occasional excesses or of steady free use, as the case may be.

Syphilis.

The amount of evidence now available of the influence of this disease upon mortality is considerable. The experience of the combined American and Canadian companies (M.A.M.I.) and of several American companies published separately show an extra mortality ranging from 21 per cent. to 117 per cent. European experiences show an average extra mortality of fully 60 per cent. When the fact is recalled that, in the selection practiced by them in the past, the life companies have, as a rule, excluded the severer forms of the disease as well as those which have been quite inadequately treated, we are warranted in concluding that the experiences quoted above express the differences due to either greater or less care in treatment, or to varying degrees of severity of the infection. It is unfortunate that there is at present available no conclusive direct evidence of the effect of treatment. The testimony of the M.A.M.I. is conflicting on the subject. Our own experience, based upon a careful selection with respect to both the severity of the disease and the thoroughness of the treatment, has been distinctly more favorable than that of the M.A.M.I. It has not been sufficiently favorable, however, to warrant our company in accepting as standard risks any of these cases however careful the treatment or mild the symptoms.

Our standards are as follows:

Cured	Thoroughly Treated.	Not Thoroughly Treated.
Initial lesion only	+ 30	+ 50
Slight secondaries	+ 40	+ 75
Marked saturations	+ 50	+ 100
Tertiary symptoms	R.N.A.	R.N.A.

It will be noticed that in the heading of the schedule we make use of the word "cured." We do not mean by "cured" that the disease has been eradicated, for we doubt whether such a result is ever achieved with certainty. The record of locomotor ataxia, general paresis, and of vascular degenerations following syphilis is strongly opposed to that view. We mean simply that the applicant is free from all symptoms. By "thorough treatment" is meant adequate supervision for at least two years, including mixed treatment, and freedom from symptoms for at least one year before discontinuance of treatment.

Gastric and Duodenal Ulcers.

The standards employed by our company in the valuation of these risks are largely based upon the testimony furnished by the Mayo Clinic, modified by our own experience. The report of that Clinic was published in 1919 in the *Proceedings* of the Medical Directors' Association. We have not dared to follow the testimony of the Mayo Clinic altogether, for the reason that we have yet to learn whether the surgical treatment of these conditions is as efficient elsewhere as it is in that institution. Besides, in dealing with cases of this kind there should always be a margin of safety.

It will be noticed in both gastric and duodenal ulcers that the extra hazard is assumed to be a temporary one which disappears altogether after a certain number of years. This may not be entirely true, but the evidence so far at hand indicates that the hazard after a limited number of years is small if not altogether negligible. We doubt, however, whether cases of gastric ulcer may safely be accepted for large amounts for several years beyond the period covered by our ratings. We believe that there is probably an extra hazard for some time thereafter. As the element of age does not seem to be a factor, the extra mortality is expressed in terms of the number of extra deaths per 1,000 for a period of years.

Gastric Ulcer With or Without Operation.

Years Since Attack.	
1st	R.N.A.
2d	R.N.A.
3d	80 extra deaths per thousand.
4th	45 extra deaths per thousand.
5th	30 extra deaths per thousand.
6th	15 extra deaths per thousand.

Duodenal Ulcer.

Years Since Attack.	(1) *Not Operated.*
1st	R.N.A.
2d	40 extra deaths per thousand.
3d	28 extra deaths per thousand.
4th	15 extra deaths per thousand.
5th	10 extra deaths per thousand.
6th	5 extra deaths per thousand.

Years Since Operation.	(2) *Operated.*
1st	R.N.A.
2d	10 extra deaths per thousand.
Thereafter	0 extra deaths per thousand.

It will be noted that in the case of gastric ulcer the same rating is applied whether the risk has been operated upon or not, while in the case of duodenal ulcer without operation a much higher mortality is anticipated than in cases successfully operated upon. We should like to say frankly that this distinction does not rest upon any insurance experience to which we have had access, but rather upon the observation and opinions of surgeons who have had a wide experience in these cases.

In the practical application of these ratings an extra premium is charged for a short period and as these premiums are without loading, neither commissions nor dividends are paid upon them.

Gall Stones, Biliary or Hepatic Colic.

The results of the Medico-Actuarial Mortality Investigation of those who had one attack of gall stones (hepatic colic) or bilious colic showed practically the same mortality, about 128 per cent., irrespective of the time elapsed since the attack. The experience of the New York Life is in line with this experience, but is, on the whole, somewhat more favorable. Our treatment is the same whether the disease is described as gall stones, biliary colic, or hepatic colic, and is as follows:

	Within 1 Yr.	1–2 Yrs.	3–5 Yrs.	After 5 Yrs.
1 attack	R.N.A.	+ 50	+ 30	+20
2 attacks	"	+ 75	+ 50	+30
Repeated attacks	"	+150	+100	+50

Drainage of the gall bladder is treated the same as one attack; but if the gall bladder has been extirpated, one-half of the foregoing rating is applied.

Renal Colic, Gravel or Calculus.

We have experienced difficulty in deciding upon a schedule of ratings for renal colic, because there have been marked differences in the results of various investigations of the subject. Thus:

Medico-Actuarial		106 percent of M.-A. Select.
Penn Mutual		115 percent of M.-A. Select.
Equitable Life		94 percent of M.-A. Select.
Mutual Life	(approximate)	110 percent of M.-A. Select.

When these statistics are studied according to number of years elapsed since the attack, the results are irregular and confusing. The experience of the New York Life, to be made known when more material has been accumulated, shows a higher mortality than any so far published. We therefore use the following ratings, which are slightly lower on the whole than our own experience and somewhat higher than the aggregate of other published investigations:

Renal Colic, Gravel or Calculus.

	Within 1 Yr.	1–2 Yrs.	3–5 Yrs.	After 5 Yrs.
1 attack	+ 50	+30	+20	+10
2 attacks	+ 75	+50	+30	+15
Repeated attacks	+100 up	+75	+50	+25

Glycosuria.

The basis of the ratings of the New York Life appears in the paper published in the *Transactions of the Actuarial Society,* October, 1917. While a great deal is heard about glycosuria, it is found much less often than albuminuria. Hardly one-sixth as many substandard policies are issued by our company to applicants with sugar as to those with albumin in the urine. Probably one of the reasons glycosuria plays a prominent part in our work is that it seems to occur more frequently among well-fed persons who apply for large amounts of insurance than among applicants for small policies.

In glycosuria it is important to differentiate between those who are and those who are not receiving dietetic treatment. To determine this, it is now our practice in suspected cases, where the amount involved warrants it, to ask the applicant to eat a test meal. This meal, which is taken in the presence of the medical examiner, includes a fair proportion of bread, starch and sugar. A specimen of urine is passed four hours afterwards, and another specimen twenty-four hours after the meal. If sugar is found in excess in either of these we look upon it as evidence that the case is under dietetic treatment and is uninsurable. On the whole, the company's experience with this simple procedure has been satisfactory, although occasionally an applicant is observed who passes the test and later is found to have sugar. Apparently, is these cases, the chemistry of the body is broken down with regard to some single article of food which happened not to be included in the test meal.

The following is our practice, which allows considerable leeway to the medical director in his rating of the risk:

Intermittent—If	clearly without diet or treatment.....	+ 50 to + 100
If	with diet or treatment.....	R.N.A.
Persistent —If	clearly without diet or treatment, but less than 1 per cent. sugar in urine.....	+ 100 to + 150
If	with diet, treatment, symptoms, or with more than 1 per cent. sugar present in urine	R.N.A.

Where there is a history of glycosuria but no trace at the present time, our treatment depends upon the time elapsed and the dietetic restrictions exercised. We disregard one finding by our own company, or one record in the past, provided repeated examinations over a reasonable period show that the previous findings were probably accidental.

A trace of acetone leads to further study. If it persists or occurs in quantity we decline to insure the risk.

Other Impairments.

We have not dealt with several of the impairments which are mentioned at the beginning of this paper, nor with several others, such as neurasthenia, appendicitis, asthma, gout, or malarial fever. Some of these impairments are not of much importance if the

attacks were mild or occurred some time ago. At a later date we may be able to discuss them.

Conclusion.

In conclusion we may repeat that, although the ratings presented by us have proved safe on the whole in the conduct of our substandard business, we expect to make changes in them in the future as new facts are brought out. We should like also to add the caution that, while they have proved entirely safe for our company, they may need modification if used by companies which follow different methods of selection or different business practices. They should not be looked upon as absolute ratios of extra mortality, but, rather, as reasonable guides in the selection of risks for insurance.

Discussion of Preceding Paper.

(written discussion.)

MR. ROBERT HENDERSON AND DR. THOMAS H. ROCKWELL:

The thanks of the insurance world are again due to Messrs. Hunter and Rogers for their frank submission of the extra ratings which their company has adopted to meet the extra mortality expected in certain impairments. These impairments when encountered in companies not doing a substandard business, should result in the rejection of the risk, for if accepted without a proper surcharge on some so-called "modified plan," they will result in the end in extra losses, which ultimately are borne by the policyholders who are properly standard risks.

Two years ago they presented their Build Table, which is the primary basis on which the risk is graded, and they explained that their table is arranged according to height and weight at different ages. At the same meeting the Equitable Build Table was explained, which adopts as standard the column of average weights for height given in the M. A. experience of ages 35 to 39. Using this standard as a basis, the various percentages of over- and under-weight are calculated, the result being a very practical and easy working formula, lending itself readily to the numerical system of rating adopted by this Society. From it will be seen the percentage of over- and under-weights, and in the table immediately below, the percentages of mortality expected according to age and deviation from the standard. As the calculation of the basic mortality is the first step employed in the estimation of the risk, it is the custom of the Equitable to adhere very closely to the table, and only in unusual instances to permit the

so-called element of personal selection or observation to enter. For, as will be seen, the table itself is sufficiently elastic to permit of debits and credits as they may accordingly appear in the individual risk.

We desire to add to the authors' warning regarding the consideration of over-weights that a claim for consideration on account of a favorable distribution of weight is a very frequent feature of such cases. Appeals for a consideration on that ground should be to a certain extent discounted, as we should expect the girth of the abdomen to be somewhat less than that of the expanded chest, even in heavy-weight cases. It will be noted that our ratings for distribution of build practically assume that the average cases will show an expanded chest at least one inch larger than abdominal measurement.

Heart Murmurs.

In a previous paper by Messrs. Hunter and Rogers, the great importance of the degree of cardiac hypertrophy, combined with organic murmurs, was well brought out. Our experience has been a very similar one, and in order that there might be a uniformity of rating on the part of individual medical directors we set about to devise a practical working basis. The first step was to obtain a representation of a normal thorax. Our search through standard works on anatomy of the chest failed to locate just the sort of outline we desired, so we enlisted the cooperation of Dr. L. Gregory Cole, who took a number of X-rays of apparently well-formed and perfectly normal chests. At the same time fluoroscopic examinations were made to locate the normal position of the apex. The result was finally obtained in the chart which we present to you. (See page 364.) Referring to the authors' table, you will observe that the rating, for instance, for a Mitral Regurgitant Murmur, will vary greatly, according to the degree of described hypertrophy, from plus 60 for the very best, with no hypertrophy, to an absolute declination if considerable hypertrophy is present. In order to simplify our work, we made a device, which is here presented. It has apparently been productive not only of evenness of rating on the part of the individual medical director, but of beneficial results in our ultimate selection.

Albuminuria, With or Without Casts.

The ratings given by the authors for albuminuria agree very closely with those used by our company if we remember they apply to albuminuria without casts, and that an additional rating is to be imposed if casts are present. Our practice is to consider these two impairments as additive, the ratings for albuminuria and casts being the sum of the separate ratings. Our rating for hyaline casts alone is 10 points for each cast in one-half-ounce of urine, using the average number found in the specimens examined. If casts are constantly present, an additional rating of

plus 50 is added; or if the number of casts exceeds 10, the case is declined. The rating for granular or other casts is obtained by multiplying that for hyaline by 1½.

This rule is based largely upon the experience of the Equitable, and in order that it may be useful to other companies it is necessary that a complete understanding be had as to the very exact method we employ in determining the number and kind of casts present. Immediately upon being passed, a portion of the specimen is poured into a half-ounce bottle containing a preservative, which after years of use has been proved most satisfactory, and which will undoubtedly preserve casts and other constituents of the urine for months. This half-ounce is centrifuged for three minutes at a speed of 2,000 revolutions per minute. A pipette removes all of the sediment, which is placed on a large slide and examined with a low power lens, each cast being counted. For differential purposes, a high power lens is used. If there is a history of casts, or if we find them in the first specimen, we call for two more samples; the results of the three combined are considered and the rating given in the table is accorded. For companies using a different method from ours, we cannot advise the ratings we have adopted, but we find the method a simple one, and in our hands it has given good results so far.

Blood Pressure.

Up to now our greatest task has been to endeavor to obtain from our examiners a proper care in their technique and to this end we have sent out numerous circulars and bulletins, explaining just how we should like to have the observations taken. The "stock letter" we distribute has helped greatly, and as both the systolic and diastolic is called for in every case, we feel we have been more than repaid by these circulars and letters, for we notice a very marked improvement in the accuracy of the observations.

Alcohol.

A very interesting point comes up in connection with the treatment of cases presenting a history of excessive use of alcohol. It may be supposed that the effect of the prohibition amendment would be to reduce the hazard in such cases. There may be in the long run a certain effect of this kind, but we cannot say that it has yet been demonstrated. Some statistics regarding our claim experience of the past few years may be of interest in this connection. We have examined our records for deaths due to acute and chronic alcoholism since January 1, 1918, with the following results: The number of deaths during 1918 from these causes were 11; in 1919 the number was 8; in 1920, it was 7; and during the first eight months of 1921 there were six deaths, which had occurred during that period and which had already been settled at the end of the period. There may have been one or

two more among the unsettled cases. These deaths included such causes of death as intoxication, alcholism, alcoholic coma, delirium tremens, dipsomania, drunkenness, ethylism, and inebriety. They did not include alcoholic cirrhosis or alcoholic paralysis, nor deaths caused by a fall while in an intoxicated condition, nor deaths due to the use of wood alcohol. These latter deaths form in themselves an interesting record. During the year 1918 we had one death from wood alcohol poisoning. During the year 1919 there were ten such deaths. During the year 1920 there were 2. During the first eight months of 1921 there were 2.

Glycosuria.

In our experience this has caused a much higher mortality than albuminuria, and a subject with present evidence of it, or giving a past history, is looked upon with grave suspicion; hence, we endeavor to use every possible precaution to determine the authenticity of the specimen and to obtain it at the high tide of digestion, following an appropriate meal of at least an average amount of carbohydrates. With a history of, or finding of sugar, we always test for acetone and diacetic acid, and when either is found we prefer to defer the risk or decline it altogether.

Past History of Tuberculosis.

The authors have listed a history of lung trouble as coming next in the order of frequency to glycosuria. It, therefore, occurred to us that it might be of value if we would state the ratings used by our company in cases showing a history of tuberculosis of the lungs. It is to be remembered that these ratings, in so far as they vary according to the build of the applicant, are based on the Equitable's Build Table already referred to. The following schedules show the ratings and the definition of the cases to which they are applied:

A. Without any Physical Signs.

	−20%.	−10%.	0.	+10%.	+20% and over.
Within 2 years: all ages	R.N.A.	R.N.A.	R.N.A.	R.N.A.	R.N.A.
2 to 5 years: age 25	+R.N.A.	+175	+125	+85	+75
35	+180	+155	+110	+75	+55
45	+125	+90	+65	+45	+30
55	+70	+50	+35	+25	+15
5 to 10 years: age 25	+170	+120	+85	+55	+50
35	+145	+100	+75	+50	+40
45	+85	+60	+45	+30	+20
55	+45	+35	+25	+15	+10
After 10 years: age 25	+85	+60	+40	+30	+25
35	+70	+50	+35	+25	+20
45	+40	+30	+20	+15	+10
55	+20	+15	+10	+10	+5

History of Tuberculosis of Lungs.—Phthisis, haemoptysis (not traumatic); pneumonia—few bacilli found and went away for convalescence; lungs affected; dry pleurisy and went away for convalescence. Chronic cough (no bacilli) and sanitarium for precaution, suspicious apices, prolonged expiration, etc.

B. Physical Signs such as Small Dry Crepitant Râles, Old Pleuritic Friction Sounds, Area of Diminished Breathing, or Area of Lost Vesicular Breathing, Area of Bronchial Breathing, or Signs of Old Arrested Focus, Moderate Emphysema, if Clearly Pertaining to an Arrested Process.

	−20%.	−10%.	0.	+10%.	+20% and over.
Within 2 years: all ages	R.N.A.	R.N.A.	R.N.A.	R.N.A.	R.N.A.
2 to 5 years: age 25	+R.N.A.	+R.N.A.	+175	+120	+105
35	+R.N.A.	+R.N.A.	+155	+110	+85
45	+175	+125	+90	+60	+40
55	+95	+70	+50	+35	+20
5 to 10 years: age 25	+R.N.A.	+170	+120	+80	+70
35	+195	+145	+100	+75	+55
45	+120	+85	+60	+45	+30
55	+65	+45	+35	+25	+15
After 10 years: age 25	+135	+95	+65	+45	+40
35	+120	+85	+60	+40	+30
45	+70	+50	+35	+25	+15
55	+40	+30	+20	+15	+10

History of Pleurisy.

The history of pleurisy is so closely allied to the history of lung trouble that we also incorporated our ratings for the cases showing this history. It must be admitted that these ratings are to a certain extent based on individual judgment supplementing experience, but they are presented for whatever they are worth:

History of Pleurisy, Dry or with Effusion.

	−30%.	−20%.	−10%.	0.	+10%.
Within 2 years: age 25..	+90	+70	+45	+25	+15
35..	+70	+50	+30	+20	+ 5
45..	+40	+25	+20	+ 5	0
2 to 5 years: age 25..	+70	+55	+35	+20	+10
35..	+55	+40	+25	+15	+ 5
45..	+30	+20	+15	+ 5	0
5 to 10 years: age 25..	+35	+30	+20	+10	+ 5
35..	+30	+20	+15	+10	+ 5
45..	+15	+10	+10	+ 5	0

Empyaema. About two-thirds rating for pleurisy.

Old adhesions without history of pleurisy..... + 15 to + 200

BUILD TABLE.

Height.	Under Weight.							Standard.			Over Weight.															Height.
5 ft. 0	77	84	90	97	103	110	116	123	129	135	142	148	155	161	168	174	181	187	194	200	206	213	219	226	5 ft. 0
1	79	85	92	98	105	111	118	124	131	138	144	151	157	164	170	177	183	190	197	203	210	216	223	229	1
2	80	86	93	100	106	113	120	126	133	140	146	153	160	166	173	180	186	193	200	206	215	219	226	233	2
3	82	88	95	102	109	116	122	129	136	143	150	156	163	170	177	184	190	197	204	211	218	224	231	238	3
4	84	91	98	105	112	119	126	133	140	147	154	161	168	175	182	189	196	203	210	217	224	231	238	245	4
5	86	94	101	108	115	122	130	137	144	151	158	166	173	180	187	194	202	209	216	223	230	238	245	252	5
6	89	96	104	111	118	126	133	141	148	155	163	170	178	185	192	200	207	215	222	229	237	244	252	259	6
7	91	99	106	114	122	129	137	144	152	160	167	175	182	190	198	205	213	220	228	236	243	251	258	266	7
8	94	102	110	118	126	133	141	149	157	165	173	181	188	196	204	212	220	228	236	243	251	259	267	275	8
9	97	105	113	122	130	138	146	154	162	170	178	186	194	203	211	219	227	235	243	251	259	267	275	284	9
10	100	109	117	125	134	142	150	159	167	175	184	192	200	209	217	225	234	242	251	259	267	276	284	292	10
11	103	112	120	129	138	146	155	163	172	181	189	198	206	215	224	232	241	249	258	267	275	284	292	301	11
6 ft. 0	107	116	125	134	142	151	160	169	178	187	196	205	214	223	231	240	249	258	267	276	285	294	303	312	6 ft. 0
1	110	120	129	138	147	156	166	175	184	193	202	212	221	230	239	248	258	267	276	285	294	304	313	322	1
2	115	124	134	143	153	162	172	181	191	201	210	220	229	239	248	258	267	277	287	296	306	315	325	334	2
3	118	128	138	148	158	167	177	187	197	207	217	227	236	246	256	266	276	286	296	305	315	325	335	345	3
4	122	132	142	152	162	173	183	193	203	213	223	233	244	254	264	274	284	294	305	315	325	335	345	355	4
Pctg.	−40	−35	−30	−25	−20	−15	−10	−5	Std	+5	+10	+15	+20	+25	+30	+35	+40	+45	+50	+55	+60	+65	+70	+75	Pctg.

BUILD TABLE (*Continued*).

Mortality Ratings.

Age.												Height.													
15	145	135	125	115	110	105	100	95	95	95	100	105	110	120	130	140	150	160	170	180	190	205	215	230	5 ft. 0
20	145	135	125	115	110	105	100	95	95	95	100	105	110	120	130	140	150	160	170	180	190	205	215	230	1
25	140	130	120	115	110	105	100	95	95	95	100	105	110	120	130	140	150	160	175	185	195	210	220	235	2
30	130	125	120	115	110	105	100	95	95	95	100	105	110	120	130	140	150	165	175	185	195	210	220	235	3
35	125	120	115	110	105	100	100	95	95	95	100	105	115	125	135	145	155	170	180	190	200	215	225	240	4
40	120	115	110	105	100	100	100	95	95	95	100	105	115	125	135	145	155	170	180	190	200	215	225	240	5
45	115	110	105	100	100	100	100	95	95	95	100	105	115	125	135	145	155	170	180	195	205	220	230	245	6
50	115	110	105	100	100	100	100	95	95	95	100	105	115	125	135	145	155	170	180	195	205	220	230	245	7
55	110	105	100	100	100	100	100	95	95	95	100	105	115	125	135	145	155	170	180	195	205	220	230	245	8
60	110	105	100	100	100	100	100	95	95	95	100	105	115	125	135	145	155	175	185	200	210	225	235	250	9
												110	120	130	140	150	160	180	190	205	215	230	240	255	10
												110	120	130	140	150	160	180	190	205	215	235	245	260	11
												110	120	135	145	155	165	185	195	210	220	240	250	265	6 ft. 0
												110	120	135	145	155	165	185	195	215	225	245	255	270	1
												110	125	140	150	160	170	190	200	220	230	250	260	275	2
												110	125	140	150	160	170	190	200	220	230	250	260	275	3
												110	125	140	150	165	175	195	205	225	235	255	265	280	4

Additional Rating for One Consumptive in Family History.

Age.										
15		60	50	40	35	30	25	20	10	10	5
20		55	50	40	30	25	20	15	10	10	5
25		45	40	35	25	20	15	15	10	5	5
30		40	35	30	25	15	10	10	5	5	0
35		30	25	25	20	15	10	5	5	5	0
40		25	20	20	15	10	5	5	0	0	
45		20	15	10	10	10	5	0			
50		15	10	5	5	5	0				
55		10	5	5	0	0					
60		10	5	0							

Correction for Ages 30 and Under.

20 Per Cent. or More Underweight.

5 ft. 0 in. −15	5 ft. 2 in. −10	5 ft. 4 in. − 5
6 ft. 0 in. + 5	6 ft. 2 in. +10	6 ft. 4 in. +15

Correction to Build Ratings

Endowments Maturing Under Age 55

Per Cent. Overweight.

N'est. Age.	15.	20.	25.	30.	35.	40.	45.	50.	55.	60.	65.	70.	75.
15	0	−5	− 5	−10	−10	−10	−15	−15	−15	−20	−20	−20	−20
20	0	−5	−10	−10	−15	−15	−15	−20	−20	−20	−25	−25	−25
25	−5	−5	−10	−10	−15	−15	−15	−20	−20	−25	−25	−25	−25
30	−5	−5	− 5	−10	−10	−10	−10	−15	−15	−15	−15	−15	−15
35	0	−5	− 5	− 5	− 5	−10	−10	−10	−10	−10	−10	−10	−10
40	0	0	0	0	− 5	− 5	− 5	− 5	− 5	− 5	− 5	− 5	− 5

For Endowments Maturing at 55 to 59 inclusive, allow 5 points LESS.
For Endowments Maturing at 60 or over, allow 10 points LESS.

Additional Rating for Two Consumptives in Family History.

Age.											
15		80	70	65	55	40	30	25	15	10	5	0
20		80	70	60	50	40	30	20	15	10	5	0
25		65	60	50	45	35	25	20	15	10	5	0
30		60	55	45	40	30	20	15	10	5	0	
35		50	45	40	35	25	20	15	10	5	0	
40		40	35	30	25	15	15	10	5	0		
45		30	25	20	15	10	10	10	5	0		
50		25	20	15	10	5	5	5	0			
55		20	15	10	5	5	5	0				
60		15	10	5	0	0	0					

Additional Ratings for Three Consumptives in Family History.

Age Pctg.		−35	−30	−25	−20	−15	−10	−5	Std.	+5	+10	+15
15		90	80	75	60	50	35	25	20	15	10	5
20		90	80	70	60	50	35	25	20	15	10	5
25		75	70	60	55	45	35	25	20	15	10	5
30		70	65	55	45	35	25	20	15	10	5	0
35		60	55	45	40	35	25	20	15	10	5	0
40		45	40	35	30	25	20	15	10	5	0	
45		35	30	25	20	20	15	10	5	5	0	
50		25	20	15	10	10	5	5	5	0		
55		20	15	10	5	5	5	0	0			
60		15	10	5	0	0	0					

Allowance for Distribution of Build.

Ordinarily no Credits for Women.

Excessive Abdomen.	20 to 30 Per Cent. Overweight.			35 to 40 Per Cent. Overweight.			Over 40 Per Cent. Overweight.		
	Age 40.	Ages 40–50.	Ages 50+.	Age 40.	Ages 40–50.	Ages 50+.	Age 40.	Ages 40–50.	Ages 50+.
+4 in.	+10	+15	+25	+20	+30	+40	+25	+50	+75
+3 in.	+ 5	+10	+15	+10	+20	+25	+15	+35	+55
+2 in.	0	+ 5	+10	+ 5	+10	+15	+10	+20	+35
+1 in.	0	0	+ 5	0	+ 5	+10	+ 5	+10	+20
0	0	0	0	0	0	+ 5	0	+ 5	+10
−1 in.	0	0	0	0	0	0	0	0	0
−2 in.	0	0	0	0	0	− 5	0	− 5	−10
−3 in.	0	0	− 5	0	− 5	−10	− 5	−10	−15
−4 in.	0	− 5	−10	− 5	−10	−15	−10	−15	−20

Ratings for Plan of Insurance.

Endowments 20 years or less, maturing under age 65 . . . . . −10
Endowments, not included above, maturing under age 70 . . . . . − 5
Limited Payment Life, 20 years or less, paid up before age 65 . . . . . − 5
Ordinary Life, or Limited Payment Life, or Endowment, not included above 0
Term . . . . . +15

Weight Correction—Women.

Where a woman applicant is above the STANDARD WEIGHT, add the following correction to the actual weight before entering the BUILD TABLE.

Age	Add
20	5 lbs.
25	8 lbs.
30	8 lbs.
35	6 lbs.
40	4 lbs.
45	2 lbs.

Ratings for Family History to be Used With Build Table.

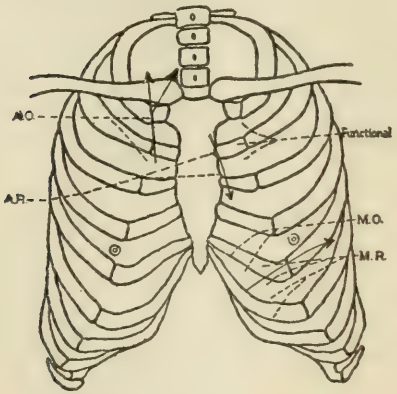
1. Great longevity in family	−10 to −15
2. Moderate longevity in family	− 5 to −10
3. Average longevity in family	0
4. Great or moderate longevity except one death from causes mentioned below under age 60	0
5. Absence of longevity (no deaths from causes mentioned below under age 60)	+ 5 to +15
6. One death under age 60 from causes below	0
7. Two or more deaths under age 60 from causes below or any combination of them	+ 5 to +15

Apoplexy or Paralysis, Insanity, Diabetes, Suicide, Cancer.

HEART CHARTS:—EXPLANATION AND INTERROGATORIES.

It is very important from our standpoint to differentiate between *Organic* and *Non-Organic* Murmurs. It is therefore well, before reporting, to bear in mind the following general characteristics of the common murmurs:

The murmurs described below are arranged in the order of the frequency of their occurrence.



Organic.

Mitral Regurgitation.—Systolic. Maximum intensity at apex, transmitted to axilla, heard behind at angle of scapula.

Mitral Obstruction.—Presystolic, running into first sound. Heard in mitral area. Not transmitted. Usually accompanied by a thrill along left margin of heart area.

Aortic Regurgitation.—Diastolic. Replaces or follows the second sound. Maximum intensity at second right interspace to third left and downwards to ensiform cartilage.

Aortic Obstruction.—Systolic. Maximum intensity at right second interspace close to sternum. Transmitted upwards into great vessels of the neck.

Non-Organic.

These murmurs may be divided into

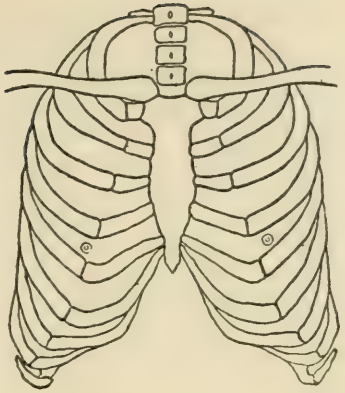
Functional of Several Origins.—Usually heard in second left interspace region and systolic in time.

Hemic.—Due to anaemia or changed viscosity of blood. Usually heard over precordia and great vessels. Systolic in time. General condition of applicant important.

Respiratory.—Due to variation of intrathoracic pressure due to respiration. Usually heard at apex and disappears when breathing is arrested.

Please indicate on the diagram:

1. Position of the apex impulse by (circle). O
2. Area over which the murmur is heard by (dotted line). ◯
3. Point where murmur is heard loudest by (cross). X
4. If murmur is clearly transmitted from the point of maximum intensity indicate in what direction transmission is noticeable by (arrow). →



Please answer the following questions as fully as possible:

5. In point of time, is the murmur systolic, presystolic, or diastolic?	
6. What is your diagnosis of the lesion?	
7. Are there any changes in the *character* of the pulse or heart sounds after exercise?	
8. Is there evidence of full compensation and if not what are the signs of incomplete or failing compensation, if any? (such as dyspnoea, oedema, or cyanosis, dilatation, etc.)?	
9. Is there *true* cardiac hypertrophy, and if so, to what extent? (Be careful to locate the apex impulse, as above described, accurately.)	
10. Aside from the cardiac condition, do you find the applicant in first-class physical condition?	
11. What is the Blood Pressure?	Systolic: ..... Diastolic: .....

.....
Medical Examiner.

.....
Name of Applicant.

Date .....

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Extract from Medical Director's Circular Concerning Blood Pressure Readings.

Experience has shown us that there are a number of factors, such as excitement, apprehension, fatigue, beginning of digestion, etc., which affect a blood pressure reading. If there is much deviation from the normal, we suggest, in order to eliminate nervousness, that you take a second observation after a period of rest. If the abnormal pressure is not due to excitement, another reading should be taken on another day.

When examining an applicant for the first time, should you find the Systolic pressure to be more than 10 points higher than that given in the column marked "High Systolic," please take a later observation and report all findings.

Systolic.

Technique: All observations should be made by the Auscultatory Method. This is done by listening with the stethoscope placed at the bend of the elbow over the Brachial artery. Air is then pumped into the cuff until the pressure stops the pulse and no sound is heard with the stethoscope. Allow the air to escape slowly. The instant the sound reappears on deflating the cuff is that at which the dial should be read as marking the Systolic pressure.

Age.	High Systolic.	Average Systolic.	Average Diastolic.	Average Pulse Pressure.
20.....	137	120	80	40
30.....	140	123	82	41
40.....	144	126	84	42
50.....	148	130	86	44
60.....	154	135	90	45

Diastolic.

By continuing to deflate the cuff a series of murmurs and tapping sounds are heard, gradually becoming less distinct, finally disappearing altogether. We wish to have the Diastolic pressure recorded just at the point at which all sounds disappear.

Our experience shows greater accuracy in taking the Systolic than the Diastolic pressure. We suggest, therefore, that our Examiners thoroughly acquaint themselves with the above simple method.

The Diastolic pressure cannot be accurately obtained without the use of the stethoscope.

Our belief is that a normal Diastolic pressure rarely if ever exceeds 100 mm.

Your instrument should be tested from time to time for accuracy.

MR. FRANKLIN B. MEAD:

The company with which I am connected entered the substandard field upon my recommendation just ten years ago this month. It began in a restricted way with occupational risks, build and family history types and some of the simpler medical impairments. Gradually the scope of the work was broadened until to-day we are able to grant insurance protection to almost all applicants, actually declining, in our recent experience, not over one or two percent. To be explicit, our rate of rejection during the period from January 1, 1920, to June 30, 1921, was 2 percent. This, however, is based upon the entire business submitted by our agents, some considerable proportion of which represents brokerage of risks recently declined by other companies. The rate of rejection on the brokered risk is many times higher than that on those submitted in the normal course of business resulting from the direct canvass of our agents in the field. Our rate of rejection on this latter class of business, excluding the brokerage business, is not in excess of 1 percent. This low rate of rejection we have accomplished through the issuance to the more hazardous types, some of which are rated as high as 500 percent, of endowment policies with increasing insurance.

The extent of our substandard business is not inconsiderable as we issued over seven thousand substandard policies in 1920, heart murmurs being, as with the New York Life, the principal impairment, 640 in number or about one-fifteenth as many cases as entered into the experience on heart murmurs published by the authors of the present paper in the fall of 1919.

The order of frequency of our impairment types closely coincides with that of the New York Life although albuminuria is second with us instead of overweight, due probably to the fact that their business is more generally found in the cities than our own where the sedentary overweight is in the ascendency. While our three principal impairments are the same as theirs, instead of constituting nearly one-half of the total they constitute only a little over one-fourth. The indications are, therefore, that the other impairments throughout constitute a somewhat larger percentage of the total with us than they do with them.

The most conspicuous discrepancy is that of goitre. We issued in 1920 substandard policies in 243 goitre cases, these ranking seventh in number, just ahead of unsatisfactory habits as to alcohol, instead of fifteenth as with them. It is quite possible that this is due to the fact that our business is so largely drawn from the Great Lakes region where goitre is supposed to predominate.

That we have attained substantial equity between our standard and substandard classes is illustrated by the fact that in 1920 the mortality on our business as a whole was 47.2 percent of the ex-

pected whereas on our substandard business the mortality ratio was substantially the same, 44.2 percent. The lower mortality experience on substandard business may properly be ascribed to the fact that we had a larger proportion of first-year business in our substandard group in 1920 than we did in our standard group and the mortality on our first year of substandard business was particularly light. The mortality on our substandard business taken as a whole seems to increase rapidly until the third or fourth year when it begins to diminish somewhat.

The accusation is frequently made that a substandard company gets the "rating-up habit." A company which does a substandard business is much more consistent in its underwriting than a company purporting to do only a standard business for the reason that it develops a more accurate sense of the mortality value of risks through the use of the numerical system than a company which merely attempts to accept or decline risks, and in reality it does not rate up a risk (at least this is true of our own company) unless there is good reason to believe that the mortality factor is such as to bring it into the substandard class.

So far as our company is concerned I have observed the effect of substandard business very closely for the past few years and I have noticed that its effect has been that we accept for standard insurance a great number of risks which are rejected by other companies. This, however, is not the result of our issuing standard policies on risks that are likely to give us a high mortality, but because we confidently believe that the risks are well within the standard limit and our experience so far has demonstrated that we are correct in this belief. It is quite true that there are some risks accepted for standard insurance by companies doing only a standard business which we would consider substandard, but opinions differ, naturally, as to the value of some risks, as is instanced by the fact that some companies doing only a standard business accept isolated risks from time to time that another company doing only a standard business would reject.

The indications are, although our volume in the various classes is not yet sufficient to give a reliable average, that the mortality in the various types of impairments varies considerably from the corresponding published experience of other companies, due, probably, as intimated by the authors in the conclusion of their paper to "different methods of selection or different business practices" and probably also to different habitat or, rather, environment. This leads to the thought that the treatment or handling of substandard business is a matter of evolution resulting from careful and painstaking study of the subject as applicable to the business fabric of the individual company. Just as surgical implements and surgical treatises do not determine the result of surgical operations, mortality ratings for substandard types do not determine the resulting mortality factors which will be experienced

on substandard business. These will be determined only by the personal equation of the underwriter, his conception of the types to be assumed in the various mortality groups or classifications and indeed another factor over which he has but little control, the type of business which comes before him for treatment. Battle as he will, the underwriter cannot wholly withstand the onslaught of a business of an unfavorable complexion, *i.e.*, the results attained by him will be considerably modified by the selectors in the field.

We employ the Numerical Method of rating for which we believe there is no substitute in connection with the treatment of substandard risks, if the Numerical Method is defined as some method by which an attempt is made to affix a numerical value to the risk as a whole by the employment, insofar as possible, of definite, fixed standards for various aspects of the risk. Even those who do not employ the Numerical Method, or *a* numerical method as defined above, must at least assign some vague quantitative value, or something of the sort, to each risk or at least each borderline risk to determine whether to accept or decline. It is inconceivable that this could be done satisfactorily from the point of view of each concrete case without some fixed or definite standards and these standards are simply a numerical percentage or some quantitative assignment which is readily translatable into a numerical percentage, although the operator will sometimes combat the possibility of such translation. It has always seemed to me that the mere battling against the sufficiency of the Numerical Method tends to lead to illogical method. A most remarkable instance of this came to my attention in a paper which I read recently on the selection of risks by methods other than the numerical in which statement was made that every class, which, in the average experience under the average selection, gives an extra mortality of 50 percent or 60 percent, is made up of two groups, one with a normal mortality and the other with an abnormally high one and that under skillful selection the division might be made under these two groups. If a class could so readily be divided into two such groups it would no longer be a class but it would be two classes. If the general mortality of the class so-called was 150 percent or 160 percent and some of the constituents were normal, there must be some in the so-called class with a mortality considerably in excess of 150 percent or 160 percent, possibly 175 percent or even 200 percent, in order to make an average of 150 percent or 160 percent and still have some of them of normal mortality. It is almost like assuming a superhuman intelligence for one to believe that he can pick 100 percent risks out of a group containing 175 percent or 200 percent risks where the average selector would be oblivious to such a wide difference. It would seem that the author would prefer not to be trammeled by anything so scientific as the Numerical Method but would

prefer an excuse now and then for taking a substandard risk on a standard basis.

The authors of the present paper present a very interesting table of ratings for albuminuria based upon the experience of their company in the past on this impairment. It is to be regretted that they did not include a similar table for albuminuria with casts. The experience of the past has no doubt been obtained, for the most part, without that powerful aid to diagnosis and prognosis, the sphygmomanometer. Doubtless in the past the mortality experience obtained on urinary impairments without the aid of the sphygmomanometer there are two groups, one which would give a lower mortality where the blood pressure is normal and which would give an extremely high mortality where the blood pressure is abnormally high. Therefore ratings for urinary impairments will be considerably modified in the future when we have statistics based upon risks whose blood pressure was known.

Last week there were presented before the Medical Directors' Association two papers on albuminuria and casts, one from an experience derived by the Metropolitan and the other by the Mutual Life. The result of these experiences showed a wide difference from that of the New York Life, that shown by the Metropolitan being particularly high. This illustrates that the mortality experiences of different companies on substandard business are likely to differ quite widely for reasons which we have referred to above.

An interesting table of mortality ratings for high systolic blood pressure is presented by the authors. As intimated by them, these ratings will be considerably modified by the corresponding diastolic blood pressure, which latter is now considered the more important of the two. These systolic ratings are somewhat lower than those we have been employing in the past but these latter were probably not higher than necessary inasmuch as we were employing them with varying diastolic readings. We have in course of preparation a new table of systolic blood pressure ratings intended to be applicable where the diastolic blood pressure does not vary greatly from the normal and it is then our intention to have other tables for diastolic to be combined with the systolic table so that the combined ratings will vary according to the range of the diastolic readings. From the few cases which have been under observation where the only impairment evident is a diastolic pressure of 110 and over, there is an indication that the mortality is extraordinarily high, the mortality being quite heavy even during the first two years owing to deaths resulting from myocardial degeneration. The authors state that the diastolic is considered normal if it is from 25 mm. to 50 mm. below the systolic. The normal blood pressure at age 20 is 120 mm.; surely the corresponding diastolic of 95 mm. would not be considered normal. Similarly, the normal blood pressure at age 50 is 130 mm.; surely 105 mm. would not be considered a normal

diastolic. It would be appreciated if the authors would comment further on this point.

Under the subject of glycosuria the authors state that a trace of acetone leads to further study. We have been making the acetone test in connection with glycosuria cases for a number of years and we have yet to discover acetone in a single specimen. The only risk which has come to us for attention in which there has been involvement of acetone was one where we received information from another company that they had found acetone upon examination without any other impairment. It is our theory that the reason that acetone does not come to our attention is that it is a manifestation in connection with a type of risk which is too far advanced in general to apply for life insurance. We have had some correspondence with Dr. J. Bergen Ogden, the laboratory expert of the Metropolitan, on this subject and he advises that while he has never kept a record of the number of cases where acetone has been found he is sure that the percentage has been small and that he is not at all satisfied that the test is worth bothering with and that the same thing may be said of the diacetic acid test. Further comments on the part of the authors on this subject would be appreciated as well as some indications as to the proportion of their cases showing a trace of acetone.

MR. ARTHUR B. WOOD:

This paper adds another debt to those we already owe to Mr. Hunter and Dr. Rogers, for their valuable contributions to the subject of treatment of substandard business and the extra mortality due to many impairments most commonly met with in practice. Probably no company has had such an extensive experience with sub-standard business as the New York Life, and no members of the actuarial and medical professions have given more intensive study to the subject than the authors of this paper. Their opinions must therefore carry great weight with us all.

The company with which I am connected has for many years conducted a sub-standard business and we are now engaged in investigating it from its inception. Although the accumulated data when subdivided according to the nature of the impairment, will probably not be sufficient to afford much information in regard to many impairments, it is nevertheless hoped that the results may disclose something of value.

At present, however, I am not in a position to contribute any additional statistical information derived from our own experience and I would hesitate to question the adequacy of any of the ratings recommended. Any suggestions I might make would be merely expressions of opinion and not based upon statistical data.

The present paper is one of a series in which Mr. Hunter has outlined the practice of the New York Life in dealing with many

important classes of impairments and has given standard ratings now in use by that company, expressed as percentages of the normal mortality. These ratings are to a large extent derived from the experience of the New York Life but use has also been made of the best information obtainable from other sources. The total available information, however, in regard to most impairments is as yet exceedingly limited. In many cases the ratings must be regarded at best, merely as approximations, while in others, they are largely the expression of opinions. To quote from the paper, "These ratings should not be looked upon as final but only as expressing the best information now available on the subjects to which they apply. . . . Ratings which may correctly express present-day experience may be found in the future to be either too lenient or too severe."

In discussing a paper of this character one's attention is naturally directed again to the general subject of the numerical method of determining the value of risks for assurance. This method has been so thoroughly discussed at previous meetings of the Society, that it would seem superfluous at the present juncture to do more than refer to it. Its advantages as well as its limitations and theoretical weaknesses, have been exhaustively considered and should be well understood. But as the use of the ratings given in this and similar papers implies the use of the numerical method of rating it seems in order to suggest that we should not lose sight of the important discussions of the subject reported it our *Transactions*. The actuary should regard the ratings chiefly in the light of an aid to enable him to form an approximate idea of the extent of the extra mortality due to any impairment but not as leading directly to any one particular system of insuring sub-standard lives. The practice of expressing the extra mortality merely as a percentage of the standard mortality is to my mind open to the serious objection that it tends naturally to the adoption of the rating-up-of-age system as the uniform plan for the assurance of such lives. In fact there appears to be a growing tendency on the part of many companies to advance the age irrespective of the nature of the mortality produced by the particular impairment. It seems to be taken for granted that the numerical method enables us to pass directly to the premium to be charged and thus to make a definite offer for the assurance of a given life. This important aspect of the selection of sub-standard business, namely, the proper use of the rating once it has been decided upon has not been dealt with in any of the papers referred to and not much attention has been paid to it in the discussions. The natural tendency then is to pass directly to a rating-up of the age.

The mere statement that risks of a certain type are subject to a certain extra mortality expressed as a percentage of the normal rate, even if correct on the average, simply enables us to form an

idea of the extent by which the expectation of life of the particular group is reduced. It tells us nothing whatever about the nature of the curve of mortality which such lives will probably follow. Is it not fully as important to know during what period of life the extra mortality is likely to be incurred and for how long it is likely to continue? We know from the Medico-Actuarial and other investigations that in many classes of underaverage lives the extra mortality appears to exist only for a limited period. In other classes the company needs to protect itself against an excessive rate of mortality during the later years of life. The system of rating up the age, carrying reserves according to the standard mortality table at the advanced age, guaranteeing surrender values based thereon and distributing the surplus annually, can hardly be defended on theoretical grounds as an appropriate method of dealing with risks belonging to either of such classes. On the other hand, this method appears admirably adapted to certain impairments, such for example, as overweight, where the resulting curve of mortality has been found to follow approximately the curve corresponding to the rated-up age. Mr. Arthur Coburn in his discussion of a paper on Numerical Rating (*T. A. S. A.*, Vol. XX, 329) after referring to papers by Sir Joseph Burn and Mr. Henry Moir, went on to say: "After an examination of a considerable number of groups of lives, sub-standard on account of occupation or medical impairments, I came to the conclusion that in the majority of classes, the curve of mortality approaches or merges with the standard curve after the lapse of an average period of 20 years. It follows that the reserves for sub-standard business should be less than for standard business.

The lien system would therefore seem to be naturally adapted to many classes of impairments. If, however, a company prefers to provide assurance for the full face value of the policy from the outset, the extra claims might be met by a substantial extra premium decreasing by gradations. It may here be observed that in the case of persons who have suffered from duodenal or gastric ulcers, the New York Life covers the extra risk by means of a decreasing extra.

In the company with which I am connected, the lien system was adopted at the outset as the basic method and until comparatively recent years, the greater proportion of sub-standard cases accepted have been such as exhibit impairments to which the lien system seems particularly well adapted. We have not followed this system slavishly, however. For instance, we have used the rating-up method for overweights. In the case of certain impairments, our practice has been to change the plan to endowment and to impose a lien as well. The combination of a lien with a rating-up of the age would also appear to be an appropriate method to apply to certain types of mortality.

The argument in support of using the rating-up system as the standard plan to be applied to all cases, is, I understand, that in

some companies it has proven satisfactory on the average when the sub-standard business is considered as one group by itself. Companies will, however, have different experiences according to the character of the mortality produced by the impairments in those classes which form the larger portion of the sub-standard business. Heretofore, such business has formed but a small proportion of any company's total business, and from a practical standpoint, it may have proven quite satisfactory merely to have made provision in advance for extra premiums sufficient on the average to meet the extra claims but if the volume of such business were to increase to any considerable extent, the importance of giving due consideration to the character of the mortality curve produced by different impairments would become more apparent. In any event it seems to me that in such an important matter, actuaries should endeavor to arrive at a closer approximation to the facts and should not be content with a system merely because it may have been found under certain conditions to produce good average results. In many instances the medical referee and actuary in consultation can probably form as good an opinion in regard to the period of life when the extra mortality will likely fall in, as they can in regard to the percentage of extra mortality likely to be experienced by a group of such lives.

If we are to apply to the practice of insuring sub-standard lives, anything approaching the same degree of scientific accuracy which we consider desirable in connection with other phases of our business, we ought at least to endeavor to adopt regulations which will ensure the payment of the extra premiums either in advance of or during the period when the extra claims are expected. If in any company the mortality curve of its sub-standard business as a whole runs considerably higher than the standard for some years, approaching it or merging with it after a limited period and if such business is all accepted at rated-up ages, the extra premiums to a large extent will be deferred until after the expiration of the period during which the extra claims will fall in. In the meantime reserves are being carried according to the normal table of mortality at the rated-up age, the guaranteed cash and other values are based thereon, and the surplus is being distributed annually. A company writing nothing but sub-standard business would be forced to adopt a different practice. The discussion of the various systems of handling underaverage lives, opens up a big subject and it is not my intention to pursue it further at the present moment. By introducing it here, it may be considered that I have departed from a direct discussion of the particular subject dealt with in the paper, but in view of the increasing tendency to pass directly from the numerical rating to a rating-up of the age without regard to the incidence of the extra mortality, I have thought it advisable to dwell at some length on what I consider a most important feature of the business.

I wish to express the deep appreciation which I am sure we all feel should be expressed to Mr. Hunter and Mr. Rogers for the generous manner in which they have given us such full and frank information concerning the practice of the New York Life. This information will undoubtedly be of great assistance to every one who uses the ratings intelligently, whatever system may be in vogue in his particular company for the insurance of sub-standard lives.

MR. WENDELL M. STRONG:

I wish to express my appreciation of the work done by Dr. Rogers and Mr. Hunter and their generosity in publishing the results for the use of other companies.

The Mutual Life has comparatively few records for comparison as we do not do business at other than standard rates. Through the courtesy of Doctors Symonds, Weisse, and Russell I am able, however, to present some statistics of our own business which may be of interest. The expected mortality used throughout is that of the Medico-Actuarial Table. The following is from Dr. Weisse's discussion of the paper before the Medical Directors' Association.

Blood Pressure.

Since 1907 we have kept a careful record of systolic, and since 1917, of both systolic and diastolic blood pressures—taken by Medical Directors and Home Office Examiners, with the hope that, after a longer period of exposure, we may obtain some valuable information. These readings were all taken under identical circumstances at the Home Office by men carefully trained to make their readings at the same point. The limits for the systolic were 100 to 150, under age 45, and 100 to 160, over age 45; for the diastolic 105; for the pulse pressure, 55.

The following table shows the results of these records,—all taken on men recommended for insurance by the Medical Examiner:

Ages.	Systolic Blood Pressure.		Diastolic Blood Pressure.		Pulse Pressure, Average.
	No. of Cases.	Average.	No. of Cases.	Average.	
15–19.....	433	121.1 mm.	215	78.2 mm.	42.2 mm.
20–24.....	1,658	124.1 "	603	79.6 "	42.4 "
25–29.....	2,332	124.7 "	901	80.9 "	42.5 "
30–34.....	2,192	124.5 "	1,005	82.0 "	41.3 "
35–39.....	1,889	125.7 "	876	83.0 "	41.8 "
40–44.....	1,466	127.5 "	642	84.0 "	42.3 "
45–49.....	961	129.1 "	424	84.8 "	43.1 "
50–54.....	567	131.5 "	250	85.8 "	45.4 "
55–59.....	262	134.5 "	103	86.1 "	47.8 "
60 and over...	168	134.8 "	71	84.9 "	50.2 "
Total.....	11,928	126.0 mm.	5,090	82.3 mm.	42.5 mm.

It appears that, while not knowing on how many actual blood pressure readings Doctor Rogers has worked out his averages, or under how similar circumstances these were taken, the coincidence of the averages obtained from the two series of readings, makes it fairly certain that they represent the average blood pressures to be expected in healthy males at the given ages.

Habits in the use of Alcohol.

We have tabulated our experience on "daily drinkers—but not to excess" (issues of 1907–1917—exposed to 1918) with considerable detail. In this class we have men who admit that they drink daily but not to excess, and have checked their statements by the report obtained when the policy was issued, and by our inspector's report on each case, made within two years of issue—throwing out all cases who are not daily drinkers or who give any history of ever drinking to excess. I think this group is about the same as Dr. Rogers's "Steady Free Users (*a*)."

For purposes of comparison, we have divided the domestic field into five areas:

(1) Northern tier of the Southern States, comprising Virginia, West Virginia, Kentucky, Tennessee and North Carolina.
(2) Southern tier of the Southern States, comprising South Carolina, Georgia, Florida, Alabama, Mississippi, Louisiana, Arkansas and Oklahoma.
(3) Other States east of the Mississippi.
(4) Other States west of the Mississippi.
(5) Canada.

The mortality of this group was higher than the average in all parts of the country.

Area.	Entrants. (1).	Deaths. (2).	Ratio. (3).	General Experience. (4).	Actual Excess (3)–(4). (5).	Ratio Per Cent. of Excess (5) to Gen'l Exp. (4). (6).
1.....	2,194	81	99%	76%	23%	30%
2.....	1,483	60	118	91	27	30
3.....	19,873	515	82	70	12	17
4.....	4,003	129	108	78	30	38
5.....	527	22	109	92	17	18
Total...	28,080	807	89%	75%	14%	19%

The light weights (Medico-Actuarial Build Groups 7–8) showed a mortality of 144 percent, the average weights (Groups 6–0–1) a mortality of 86 percent and the heavy weights (Groups 2–3–4–5) a mortality of 89 percent. The mortality of the daily drinkers of the different ages showed as follows:

Ages.	Entrants. (1).	Deaths. (2).	Ratio. (3).	General Experience. (4).	Actual Excess (3)–(4). (5).	Ratio Per Cent. of Excess (5) to Gen'l Exp. (4). (6).
15–19.....	293	6	114%	84%	30%	36%
20–29.....	7,908	125	84	73	11	15
30–39.....	10,574	212	88	73	15	20
40–49.....	6,718	246	94	77	17	22
50–59.....	2,261	161	87	74	13	18
60 and over	326	57	91	77	14	18
Total....	28,080	807	89%	75%	14%	19%

There were 93 deaths from tuberculosis in this group,—17 among the light weights, 76 among the middle weights and none among the heavy weights. Cirrhosis of the liver caused 12 deaths, 7 among the average weights (0.7 per 10,000 exposed), and 5 among the heavy weights (2.5 per 10,000 exposed).

Gall Stones, Biliary or Hepatic Colic.

There were applicants giving a history of one or more attacks of gall stones, biliary or hepatic colic; all treated medically—none accepted until at least five years had elapsed since the last attack:

MEDICAL IMPAIRMENT—CLASS 12. (ISSUES OF 1907–1917—EXPOSED TO 1918.)

Entrants. (1).	Actual Deaths. (2).	Expected Deaths. (3).	Ratio. (4).	General Experience. (5).	Actual Excess (4)–(5). (6).	Ratio Per Cent. of Excess (6) to Gen'l Exp. (5). (7).
415.....	16	14.8	107.7%	75%	33%	44%

Renal Colic, Gravel or Calculus.

Dr. Rogers gives the Mutual Life experience, 1885–1906, for renal colic, gravel or calculus as, approximately, 110 percent M.-A. Select. In 1908 we began to accept cases with a history of one or more attacks of renal colic, gravel or calculus, six months after the last attack under age 40, and one year after the last attack over age 40, provided that applicant was under 20 percent overweight, had a satisfactory blood pressure, furnished a satisfactory statement from the physician who took care of him during his last attack, a negative microscopical examination of urine of good specific gravity, made either at the Home Office or by the Medical Referee, and no other *important* impairment.

MEDICAL IMPAIRMENT—CLASS 24. (ISSUES OF 1907–1917—EXPOSED TO 1918.)

Entrants. (1).	Actual Deaths. (2).	Expected Deaths. (3).	Ratio. (4).	General Experience. (5).	Actual Excess (4)–(5). (6).	Ratio Per Cent. of Excess (6) to Gen'l Exp. (5). (7).
1,093...	36	41.6	86.5%	75%	11.5%	15%

This experience gives, so far, more satisfactory results than our previous investigation, but it remains to be seen what the next ten years will bring forth.

Syphilis.

At the twenty-ninth annual meeting of the Medical Directors' Association at Newark in January, 1919, Dr. Weisse quoted the Mutual Life experience of syphilis based on investigation of issues of 1885 to 1906, exposed to 1915, which was briefly as follows:

Medical Impairment. (1).	Entrants. (2).	Exposures. (3).	Deaths. (4).	Ratio. (5).	Excess (5)–100%. (6).
Class 1.....	176	1,631	18	135.5%	35.5%
" 2 and 3.....	134	1,261	18	137.5	37.5
" 4.....	122	1,121	17	161	61
" 1, 2, 3, 4 (combined)..	432	4,013	53	143.6	43.6

The excess in this table is based on 100 percent as the general experience.

Albuminuria

The following is from a paper presented by Dr. Russell to the Medical Directors' Association in October, 1921, showing the experience (Domestic, *i.e.*, U. S. and Canada, Issues 1907–1917, Exposures to 1918) of the Mutual Life in cases with a history of albumin.

In regard to albumin and casts the Mutual Life made no contribution to the report furnished by the Joint Committee on intermittent albuminuria because all the cases which had been accepted by the Mutual Life had a history of albuminuria, which was cleared up by three consecutive normal specimens. This procedure, therefore, put all such cases into the category of accidental albuminuria.

The following table shows the results when albumin was found on examination and the case was finally accepted under the above conditions:

ALBUMIN FOUND ON EXAMINATION.

Insurance Years 1–5.

Ages.	Entrants.	Expos.	Deaths.		Ratio Per Cent.
			Act.	Expect.	
15–29	623	1,863	14	7.793	179.8%
30–44	286	912	5	4.701	106.4
45 and over	112	327	4	4.089	97.8
Total	1,021	3,102	23	16.583	138.7%

All Insurance Years.

15–29	.....	2,203	14	9.450	148.1%
30–44	.....	1,116	8	6.035	132.5
45 and over	.....	384	6	5.144	116.8
Total	.....	3,703	28	20.629	135.7%

Of the twenty-eight (28) deaths, eight (8) were from tuberculosis of the lungs; this constituting nearly 30 percent of the total number of deaths, and more than one half of the fourteen (14) deaths in the age period fifteen (15) to twenty-nine (29).

The following table gives the combined results where albumin was found on examination or once within 5 years of date of application without examination for casts,—cleared up by examination of three consecutive specimens free from albumin.

ALBUMIN FOUND ON EXAMINATION OR ONCE WITHIN 5 YEARS OF APPLICATION—NO EXAMINATION FOR CASTS.

Insurance Years 1–5.

Ages.	Entrants.	Expos.	Deaths.		Ratio Percent.
			Actual.	Expected.	
15–29	1,379	4,124	24	17.312	138.6%
30–44	871	2,723	17	13.914	122.2
45 and over	344	1,032	10	13.952	71.7
Total	2,594	7,879	51	45.178	112.8%

Insurance Years 6 and Over.

15–29	.....	659	1	3.230	31.0%
30–44	.....	574	8	3.837	208.3
45 and over	.....	182	6	3.608	166.2
Total	.....	1,415	15	10.675	140.4%

All Insurance Years.

15–29		4,783	25	20.542	121.7%
30–44		3,297	25	17.751	140.9
45 and over		1,214	16	17.560	91.1
Total		9,294	66	55.853	118.1%

The experience where albumin was found over five years in the past was also investigated and for seventeen deaths in all the mortality was not higher than normal.

The causes of death for cases where albumin was found on examination, or at any time in the past, were as follows:

Cause of Death.	Ages 15 to 29.	Ages 30 to 44.	Ages 45 and Over.
Typhoid Fever	2	2	
Septicaemia	1		
Tuberculosis of Lung	12	1	1
Cancer			1
Alcoholism	1		
General Paralysis of Insane		3	
Heart Disease	2		2
Angina Pectoris		1	
Pneumonia	1	4	2
Cirrhosis of Liver			1
Bright's Disease		5	5
Suicide	1	7	
General Disease	1		
Chronic Poisoning		2	
Inflam. of Brain		1	
Apoplexy	2		2
Diseases of Nervous System		1	
Endocarditis		1	
Bronchitis			1
Ulcer of Stomach		1	
Diseases of Stomach		1	
Appendicitis		1	1
Biliary Calculi			1
Diseases of Digestive System	1		
Drowning	2		
Traumatism	3	3	1
Sudden			1
Auto Accident	1		
Total	30	34	19

While this material is not abundant, it shows results so much at variance with the report on intermittent albuminuria, that it was deemed advisable to submit it.

The Committee's report was based largely upon information obtained from substandard cases, while the material reported here is based upon cases which were accepted at standard rates and in

which the albuminuria was regarded as of no consequence. It is evident, however, that albuminuria, even so-called accidental, cannot be ignored, particularly among the young, where it seems to indicate a liability to tuberculosis. Perhaps it may be regarded as due to some septic infection which may be tuberculosis or which may predispose to tuberculosis, as well as to slight irritation of the kidney. In the older ages the preponderance of Bright's disease as a cause of death, indicates that accidental albuminuria may be significant of chronic Bright's.

DR. WILLIAM MUHLBERG:

I am very sorry indeed that I did not know two or three days ago that I might be honored by being called upon to discuss this paper, because I could have written out my remarks and could have stated more clearly and more logically the few ideas I hope to express. You will therefore pardon me if I seem to ramble. In the first place, we are greatly indebted to Mr. Hunter and Dr. Rogers for their generous contribution. Personally, I cannot understand how a company would venture to write substandard business, unless it has statistics of this kind. The Union Central does not write substandard business, but I find nevertheless, that the ratings for the principal impairments and particularly the numerical rating of risks are of great value to us.

I cannot quite understand the attitude of a great many medical directors towards the numerical rating system. They are very enthusiastic with reference to the ratings of the principal impairments but in considering the numerical rating they appear to lack confidence. They think the matter is too theoretical. They assume the same attitude as a mathematician who feels that arithmetic is all right but when you mention to him trigonometry or calculus you are becoming too theoretical, and therefore unsafe. As a matter of fact, medical directors formerly employed a sort of numerical rating. We did not pay so much attention to a single impairment, but rather visualized a picture presented to us in the application, and decided whether or not the risk was good or bad and therefore could be accepted or declined. Consideration of a single impairment may sometimes cause complications. Very often when I rule on cases having only a single major impairment in mind, I decline it according to our rules, although I feel that sometimes such a risk might be approved even for standard business. Numerical rating now enables me to handle a case on a more or less scientific basis and enables me to argue with the agent on a more scientific basis. The agent is less inclined to argue if you present the whole matter to him in a statistical way,—perhaps because he does not understand it so well. Even so, this occasionally helps. One point which I think is of importance, that Dr. Rogers and Mr. Hunter have brought

out, is that it is necessary for a medical director to review the figures of the numerical rating after they have been tabulated. I may illustrate this by an example: Let us assume that an applicant has a history of blood-spitting, rated 30 points, and that he is light weight, rated 20 points, making 50 points in all. I do not believe this combination should be represented by 50 points, for the reason that the two impairments combined form a serious combination, from a medical standpoint. On the other hand, if an applicant has a history of blood-spitting, for which he is rated 30 points, and is overweight, for which he is rated 20 points, I again do not believe that 50 points is a fair rating, for the reason that the overweight counteracts somewhat the impairment of blood-spitting.

At our last Medical Directors' meeting we were addressed by Dr. Gaylord, who spent several years in Germany and studied their work in the clinics there in the treatment of cancer. He states Germany has gotten wonderful results because they have developed the X-Ray to the "*n*th" degree—and you know what that is. Radium was not available during the war period and therefore they were compelled to rely on the X-Ray. Their good results are due to the fact that in their clinics they treated every case through the co-operation of the surgeon, the pathologist and the technician. Any one of these working alone (which is the method followed in this country) would probably not secure the same favorable results.

So in our work, if the actuary and the medical director co-operate, much better work can be done. In my opinion, the paper of Dr. Rogers and Mr. Hunter is so valuable because Mr. Hunter has a splendid knowledge of medicine, while Dr. Rogers is well versed in actuarial science. Such co-operation between the actuary and the medical director should be encouraged in every insurance company.

Mr. Mead made a statement with reference to acetone that I am sorry I cannot entirely endorse. We examine most samples in our laboratory for acetone and our difficulty is that we find it too often,—perhaps in one percent of our cases. The test that we use is extremely delicate and we do not consider our findings positive unless rechecked by the distillation test. We find that every year we reject three or four cases through our findings of acetone and because we have reason to suspect that these cases are diabetic under treatment.

Acetone represents the smoke that comes from the imperfect combustion of fats in the body. Just as in a furnace the coal will not be consumed unless started with wood, so in the body, fats, which serve the purpose of coal, will not be properly consumed unless a certain amount of starch is burned simultaneously with the fats. In diabetes the body has difficulty in burning the starches. It is quite easy for a mild diabetic, through diet, to get

rid of the sugar in his urine, but when he attempts to do so acetone appears in his urine. Where we suspect this we order the glucose test.

With reference to the coincidence of albuminuria and tuberculosis, it has been our observation that albuminuria is particularly prone to occur in young anemic individuals. Tuberculosis also occurs in this type of young persons. I doubt very much whether the albumin is an expression of tuberculosis; I feel rather that it is prone to occur in the same class of individuals that are likely to develop tuberculosis.

(AUTHORS' REVIEW OF DISCUSSION.)

MR. ARTHUR HUNTER AND DR. OSCAR H. ROGERS:

We are under a debt of gratitude to those who have given such valuable information in connection with the discussion of the paper presented by us. The method of the Equitable, which has been so freely given by Dr. Rockwell and Mr. Henderson, is of especial interest to all of us.

Two matters have been discussed which were not touched upon by the authors—namely, the numerical system of rating risks and the method of meeting the extra mortality under substandard policies. With regard to the former, the matter has been thoroughly discussed from all points of view and it does not seem necessary to consider it further at present. With regard to the latter, the numerical method of rating risks was in existence four years before the advance-in-age method was adopted. In 1907 when the companies organized in New York State were required to issue annual dividend policies only, we studied carefully the lien, extra premium, advance in age, and special class methods with the view to determining which was best suited to our needs. We realized that there were advantages and disadvantages in connection with each of these systems. It would involve an extended discussion to consider each of these methods in detail, and accordingly we shall point out simply that the lien system does not carry as high a mortality as is popularly supposed. In this connection a table prepared by one of the authors in 1915 is given on the next page.

It is apparent that the lien system cannot cover a large extra mortality unless the lien is very heavy and is reducible by small annual decrements.

Theoretically the lien, extra premium, and advance in age could all be used in a company to meet the different conditions. There are two obstacles in the way of this: first, that a complicated system is not best for the agency force; and, second, that we do not yet have a knowledge of the mortality curves in relation to the normal except in a comparatively few impairments.

ADDITIONAL MORTALITY WHICH LIEN WILL COVER, THE LIEN BEING REDUCIBLE BY THE ANNUAL PREMIUM WHICH IS CHARGED BY A LARGE INSURANCE COMPANY ISSUING NONPARTICIPATING INSURANCE ONLY—CALCULATION ON AMERICAN 3 PER CENT. BASIS.

	Lien per $1000.	Percentage of American Mortality Borne by Lien.		
		Age 25 at Issue.	Age 40 at Issue.	Age 55 at Issue.
Ordinary Life.....	$300	9%	6%	5%
	500	31	22	17
	700	92	65	49
20 Payment Life.....	300	9	7	5
	500	28	23	18
	700	78	69	52
20 Year Endowment....	300	11	9	6
	500	39	33	21
	700	120	99	60

With regard to Mr. Meade's statement that not over 1 percent or 2 percent of the business was declined, it is likely that means were taken to prevent some of the undesirable business from reaching the home office. If a company is known to accept under-average risks and encourages its agents to canvass among them, the percentage of declination is likely to be distinctly higher than 1 percent or even 2 percent. Of course the percentage of declinations can be kept down by a free use of an inquiry blank in cases of doubt or by refusing to consider any cases declined by another company within a year unless all the facts are first submitted.

With regard to the point raised by Dr. Muhlberg, the numerical system is entirely applicable to our method of handling cases of blood spitting. Our table of ratings follows the lines of that presented by Dr. Rockwell and Mr. Henderson. It will be noticed that effect is given to weight, so that a lightweight person with a history of tuberculosis receives a much heavier rating than an overweight applicant. For example, at age 35 the applicant who had a history of tuberculosis from five to ten years ago would be rated + 145 if 20 percent underweight, but only + 40 if 20 percent overweight.

With regard to Mr. Meade's question covering albuminuria, with casts, our experience is not extensive as we have insured comparatively few persons with that impairment. The method used by us at the present time is practically that of the Equitable, but changes may be made in the not distant future.

Some New Problems Affecting Life Insurance.

BY

E. B. MORRIS.

Practically all of the insurance placed on the books of life insurance companies has been through the individual solicitation of the agent with the recent exception of so-called group insurance. Attempts which have been made to induce the individual to purchase insurance through advertisements and without the aid of solicitors have been eminently unsuccessful.

Group life insurance without medical examination has undoubtedly introduced some new ideas into the life insurance world and as many of these ideas possess practical value and as they introduce perhaps a new field for discussion among members of this Society, I have here attempted to outline in a rough way, some of the more important phases in this field which have come to my attention and which it will be seen segregate themselves from the usual lines of life insurance underwriting. Some of these ideas are capable of development along healthy lines.

The fact that group life insurance has developed along such substantial lines, as has been the case, is in my opinion to a considerable extent due to the fact that the actuaries of the companies which were interested in group insurance development have met informally to discuss their common problems so as to avoid the mistakes which might otherwise have developed had each company treated the subject independently; consequently I believe a discussion of the matters presented herein will be of common benefit to all, especially as most of the subjects introduced have not as yet been discussed in the *Transactions*.

To repeat a bit of history, the activities of certain companies which early issued group insurance resulted in a conference of the Insurance Commissioners and the ultimate adoption in certain states of a definition of group insurance and the adoption of the same principle, at least, in other states. This definition of group insurance provides in the main that group insurance may be written on the employees of a common employer where the employer

pays the premium and where the insurance as to any individual is such as to preclude selection and where the group must consist of at least a minimum number—50 lives. The definition further provides that such insurance is permissible where the employee and the employer jointly contribute towards the payment of the premiums, provided that at least 75 percent of all eligible risks are insured. It will be seen, therefore, that group insurance as permitted by the laws of various states involves insurance upon employees of a common employer. While this definition is thus limited, it unquestionably has done much towards the establishment of group insurance on substantial lines. It will be noted that group insurance on associations and fraternal organizations as such is prohibited, and wisely so, for the reason that were group insurance possible on the lives of members of associations there would result the same difficulties which have confronted assessment insurance companies on the Term plan despite the fact that the premiums were to a certain extent guaranteed, by which I mean that the maintenance of a level average rate for all members could be obtained only through the introduction of new members at younger ages in increasing numbers—in the end an impossible condition—with the result necessarily of increasing the average rate per individual, and of the dropping out of younger members who could purchase their insurance at lower rates individually.

Under the definition of group insurance an association of the employees of a common employer might under certain circumstances be insured under a group policy; namely, if 75 percent of all employees eligible were insured, and the insurance companies writing group insurance have had more or less of such cases presented. It is hardly necessary to state that to the insurance company such groups are not as favorable as the group cases in which the employer pays the entire premium on all eligible risks unless complete coverage is compulsory—generally an impossible condition. Individual solicitation to bring in the requisite 75 percent of all eligibles is essential, which necessarily increases the cost of the plan, generally on the part of the insurance company. Where the employer pays the major portion of the premium, this plan may be successfully worked in that under these circumstances fairly complete coverage may be possible, but otherwise difficulties are manifest. While an insurance company might issue such a group policy, the company is in a measure obligating itself to con-

stantly keep the membership in a satisfactory state. Competition on such cases has generally necessitated the issuance of such insurance at the same rates as where the employer pays the entire premium, although obviously the risks may not be the same, which fact is suggested in the report on Group Mortality by Mr. E. E. Cammack in the last *Transactions*.

The definition of group insurance admittedly is not perfect. An association of employers in a certain territory, all in a certain line of business, votes that each employer belonging to the association will purchase insurance on his employees along a common formula for all employees. Let us assume, for example, that there are 1,000 employees in all to be insured. Through the adoption of a common formula of coverage, there is no undue selection on the part of any individual. In the association let us assume that there are 10 employers, several of whom employ less than 50 employees. The definition of group insurance precludes the issuance of group policies at group rates to such employers although under the circumstances named there is no undue selection.

Again, let us assume an association of officers of various concerns, the membership of which is due entirely to the occupation of the individual; for instance, an association of the purchasing agents of manufacturers all engaged in the same line of business. The object of the association is apparent, the membership is practically compulsory, and presumably the expenses of the organization are met through contributions by the companies whose purchasing agents constitute the membership. Here we have a group with reasonably ample funds, which association could properly purchase insurance on its members out of the current funds of the association, yet such a group risk would be prohibited for the reason that there was no common employer.

The above cases are only illustrations of the rigid application of the group definition and suggest a possible broadening of the definition in such a way as to include business in which manifestly there is no selection as far as any individual or any group of individuals is concerned.

For the benefit of the underwriter, a general principle may be set down; namely, that where the payment of premiums is met by the employer or from general funds, a much more favorable mortality may be expected than when the individual covered is responsible for his own insurance premiums either as determined by his

own age or as determined by any method of averaging premiums. Group insurance supposedly originates not from the desire of the individual to seek insurance but from the desire of the employer to furnish a small amount of insurance protection to all his employees who satisfy certain requirements as to length of service and capacity to work. There is thus initially an elimination of a class of undesirable risks incapable of steady work and there is no possibility, or but a small possibility, that large amounts of insurance will be placed upon any individual contrary to the interests of the insurance company.

The rapidity with which group insurance has been written and the persistency of such business during the present period of enforced economy among employers are strong indications that employers value this insurance. It is becoming more and more apparent that group insurance does not compete with regular life insurance but that rather it educates a large group of individuals to purchase more adequate insurance upon their lives through the issuance of individual policies.

We have referred to the two typical group cases involved in the definition. The business involving complete coverage on all eligible employees of an employer where the employer pays the cost constitutes by far the greater volume of business which has been written. We have stated that the group definition permits also a coverage of the association type of employees where the employer and the employee may jointly contribute.

We may now consider other forms of bulk or wholesale life insurance involving bulk treatment in underwriting, accounting, or the general handling of business which is outside the field of group insurance as defined although somewhat related thereto.

The Small Employer Group.

The definition of group insurance precludes the issuance of such contracts on less than 50 employees. As far as the employer is concerned the arguments in favor of group insurance apply equally as strongly to his small group as to the employer of the large group as the small employer is more closely in touch personally with his employees. It has been essential, therefore, to devise some plan of insuring the employees of the small employer, assuming that the insurances to be written shall follow an acceptable formula on the

present and future employees and that the employer will pay the premium. In such cases it is desirable to establish a definite agreement with the employer as to conditions under which such insurances shall be written. Where the employer pays the premium it is usually advisable to issue insurances on individual policies on the Term plan because of the low investment involved and on a One-Year Renewable Term plan for adjustable insurance where the formula provides for increasing insurance with service. The group definition has set 50 as the arbitrary number below which the writing of insurance without medical examination is unsafe. Our data is still too inadequate to prove whether 50, 100, 250 or any other number is the magic boundary line below which medical examination must be required for the safety of the insurance company, although we do know that the mortality which the companies have experienced on the smaller group cases has been fully as favorable as on the more moderate sized groups. It is, however, evident that the smaller the group the greater the possibility of selection as far as the group is concerned. Assuming that this elimination of adverse selection can be satisfactorily handled by proper underwriting, it is clear that there is a very large field for this type of insurance coverage since there are a great many more employers with less than 50 employees than there are employers with over 50 employees. If individual risks can be safely written it is apparent that by modifying the mortality, exposure and lapse assumptions used in handling regular individual contracts by the experience shown on the group contracts, insurance can be written to cover such employees.

The cost per capita under such "small employer" groups is necessarily higher than under the larger groups where special group rates apply, as, necessarily, in order to avoid discrimination the regular manual rates of the company for individual insurances must be charged. The insurance company, however, can save something in the expense due to the bulk treatment of such risks and consequently can modify somewhat the standard of its selection. Certain companies have gone so far as to write such business involving over 25 employees without the requirement of medical examination provided they could reject individuals on which inspection reports were unfavorable or could reject the entire group. Other companies have proceeded through the use of a modified

medical examination, retaining the privilege of declining or rating any individual.

Co-operation of the Employer in Obtaining Insurances for His Employees.

The large employer who has already purchased group insurance and whose employees are educated to the advantage of life insurance through the possession of a group certificate can be more readily influenced to aid his employees in the purchase of additional insurance protection. Such an employer has already done a very real social service in granting an unrestricted coverage to all employees including the rare individual who is almost uninsurable as an individual risk. The man, however, who is a good insurance risk and who will presumably continue in his employ for the rest of his working lifetime will be a better workman and a more desirable citizen if he is adequately insured and purchases such additional insurance at the rates granted by the old line companies for his particular age, occupation and physical condition. Such an employer may be more readily approached on a proposition of financing the insurance premiums of his employees in such a way as to permit payments by the employee on the monthly basis as a deduction from payroll, the employer in turn paying the premiums on possibly a quarterly basis. The risk to the employer is necessarily small and may be entirely neutralized by the use of proper assignments. On the other hand the employer renders a distinct service to his employees in obtaining for them benefits which they could not individually obtain. There is involved a small cost to the employer because of the necessary bookkeeping but such cost is much more than balanced by the results of the service rendered. Such a plan encourages the purchase of more adequate insurance on the part of the employee for the reason that where premiums are spread over monthly periods the average individual can purchase more insurance than is possible where premiums are payable directly to the insurance company on an annual, semi-annual or quarterly basis.

Insurance companies have refrained from issuing directly monthly premium policies because of the higher costs of collection which are involved and because of other complications. Under the plan suggested the employer bears this additional cost for which, as stated, he receives adequate compensation through the service rendered to his employees. The possibilities of this kind for broadening the field of life insurance are many.

The employer may desire to go even further and to make some slight contribution towards the insurance premiums payable by his employees. He may, for example, make an increasing contribution with the increase in length of service of his employees as a recognition of such service.

Insurances thus written are, of course, subject to ordinary underwriting requirements and necessarily affect only part of the employees, consequently the plan as outlined is in no way a substitute for group insurance but may satisfactorily be used as a supplement thereto. As a matter of fact, it is not necessary that the employer be a purchaser of group insurance. Such business must necessarily be through the solicitation of agents working with the permission of the employer in that the peculiarities of the individual risk as to form of policy and amount of insurance are involved.

The plan outlined of course differs in scope from that outlined in the preceding section, although containing certain characteristics of the bulk insurance idea through the method of handling premiums.

Home Building or Housing Contracts.

Concerns and even associations have been formed for the granting of mortgages for the purpose of home building, such mortgages being ordinarily reduced by some amortization principle. Ordinarily the owner of a house with such mortgage expects to clear off such mortgage provided he lives long enough. The death of the home purchaser before his mortage is paid for may be embarrassing not only to his family but also to the lender as necessarily the latter is not desirous of foreclosing a mortgage under these circumstances if it can possibly be avoided. Insurance assigned against such indebtedness has, of course, in the past been written but the issuance of decreasing Term policies so as to agree with the amortization feature is a more recent development. Perhaps the most recent innovation has been the issuance in certain states of a blanket contract quite similar in principle to the group contract but providing for insurance coverage exactly meeting the liability of the home purchaser in event of death; in other words, a blanket contract which provides for the addition of new risks as houses are built and mortgages made and the cancellation of risks at death or at the termination of the mortgage. In such cases of course evidence of insurability is required at the issuance of the insurance.

The same principle may be applied to other forms of indebtedness; for example, insurance against the indebtedness of employees who purchase stock in a concern on the instalment plan.

Group Annuity Contracts.

Group insurance has also introduced into the insurance field the possibility of the issuance of group annuities. This is possible on larger employer cases and where the employer has established suitable rules for the pensioning of employees who attain a certain age. Rather than pay such annuities from year to year out of the funds of the employer, there is a certain advantage to the employer in purchasing annuities from an insurance company upon such annuitants or pensioners which under the circumstances named is possible under a blanket annuity contract. Under these circumstances the insurance company can afford to grant annuities at somewhat lower rates than would be charged individual annuitants because of the absence of individual selection. The employer benefits in several ways. In the first place, by the purchase of annuities he avoids all future care as to the payment of pensions and in the second, he is able to say to the pensioner in presenting the annuity certificate that he has earned his pension for life as is represented by the certificate and that no matter whether the employer goes out of business or not the pension will be paid by the insurance company to the pensioner. Most pension plans are contingent upon a certain length of service. The purchase of deferred annuity contracts might be possible on the annual premium plan were it not for the fact that discontinuance of employment before the pension age necessarily leaves an uncompleted contract unless the employee himself cares to complete the contract by the payment of subsequent premiums. Incidentally, the employer under these circumstances may lose what he has put into such contracts and for no apparent purpose.

It may be reasoned that it is much better for the employer to set aside from year to year sufficient funds to meet the purchase of single premium annuities when his employees reach the pension age, for in this way the employer avoids the difficulties of the withdrawal rate which is a real difficulty in all pension calculations.

Utilizing the Thrift Idea in Insurance Purchase.

Fundamentally the thrift idea is expressed in all life insurance contracts through the liability of the insured to pay a premium for his protection at stated times. In the ordinary solicitation of life insurance, however, this principle is not particularly emphasized as against the broader protection arguments.

You have all heard of the so-called "Christmas Clubs" which are simply based upon the requirement of periodic weekly or monthly deposits in a bank for limited periods. More recently this same idea of periodic deposits in a bank in order to produce a return at the end of a certain number of years has been coupled with an insurance feature in an insurance company thus associated with the bank in order to protect the deposits in event of death. For instance, an individual arranges with a savings bank to pay a certain amount of deposit each month for a period of, let us say, 10 years, at which time the bank guarantees that such deposits plus compound interest will equal a certain amount or unit, say, $1,000; the insurance contract providing either that a sufficient amount of insurance will be added at the death of the insured so that with the accumulated deposits the same unit will be produced at the time of death, or for an insurance equivalent to the unit itself, in which event at the death of the insured there would be paid not only the unit of the insurance but in addition the accumulated deposits in the bank. Obviously, the plan is much more successful than where the bank alone guarantees accumulation of the monthly deposits for the reason that the depositor may withdraw his deposits with interest at any time without penalty; in other words, there is not the compelling influence that is involved where a life insurance contract on the monthly plan is issued in combination with bank deposits. Under this plan the insurance company carries the insurance feature and the bank the investment feature. The plan has therefore been criticized from the insurance point of view to the effect that the insurance company is leaving its own field and establishing a certain competition against its own short-term Endowments. From a practical viewpoint this criticism loses weight when we consider that only a comparatively few short term Endowment policies are issued, the underlying principle of life insurance companies being to sell life insurance protection.

The principal point, I believe, in this connection is that the so-

called "insurance-savings" plan as above described is primarily based upon the thrift idea of the compulsory monthly deposit and consequently this plan will appeal to individuals where the ordinary insurance contract will not. In fact, this class of insurance involves a field which practically does not touch upon the field of individual life insurance solicitation. Again, the life insurance company would be the benefactor under such plans not only in encouraging the thrift principle but also the insurance idea among a class of risks which, as I have stated, would not ordinarily be interested in life insurance. As a matter of fact, it is customary to use specially trained salesmen in connection with such solicitation in selling the one idea of the monthly savings insurance plan. Such business is, of course, written upon evidence of insurability but inasmuch as the class of risk involved is interested mainly because of the thrift idea it may be reasonably expected that results from a mortality point of view will not differ materially from the experience on Endowment policies. How this class of business will stand up from a lapse point of view is somewhat problematical.

It should not be overlooked in this connection that the bank is in no way acting as the agent of the insurance company nor as a seller of life insurance, but simply as a temporary depository for premiums, the business being solicited through the activity of the insurance agents, although the bank necessarily may co-operate on the expense of advertising, etc.

The Raising of Endowments.

Various plans have been advocated as an aid in the establishment of endowment funds, such as funds to be donated to a college by a class at a certain anniversary after graduation, the establishment of sinking funds to meet the maturity of bonds issued in connection with the building of a church, fraternity house, or any institution in which there is a fraternal element. Frequently life insurance has been advocated for use in such cases. For example, small Endowment policies have been sold to members of a college graduating class, let us say, to mature at the 25th anniversary, the policies being then payable to the college or proper trustees. We have here, therefore, a question of bulk or wholesale insurance in which the underwriting principles differ considerably from those of ordinary business. In the writer's judgment the issuance of small Endowment policies, the premiums on which are

to be paid individually, is open to certain objections because of the possible lapse and the consequent failure in the realization of the endowment. Consequently, it is suggested in such cases that insurance policies to the extent of the proposed endowment be taken out on a few members of the group. For example, if $50,000 is to be raised, 10 members of the group should be insured under 10 policies of $5,000 each. The premiums on such policies should be paid by a representative of the class, say the treasurer, such funds being raised through class dues, the point being that the treasurer would be in a much better position of meeting the payment of premiums and thus preventing lapse and the failure of the endowment than would the individual members of the class, each of whom possessed a small Endowment policy, of, let us say, $250, and each acting independently.

The main advantage of the insurance policy in this connection, however, is represented in the compulsory premium payment, that is, the liability of failure if premiums are not properly paid.

Non-Employer Associations.

Despite the fact that group insurances cannot be written on the non-employer associations there has been considerable demand for insurance coverage on such groups through the issuance of individual policies, generally on the increasing premium Term plan and for the same amount of insurance on each member, with the suggestion of waiver of medical examination if the group is large enough, but new members to produce satisfactory evidence of insurability, the thought behind such requests being that because such insurances are written on all members of a group and for common amounts the rates could be modified thereby and the members would thus procure cheaper insurance than they could possibly obtain individually.

From a theoretical point of view, such a group is perhaps insurable provided each member of the group pays the cost of his own insurance, but from a practical standpoint such insurance is bound to be unsatisfactory for the simple reason of the increasing cost to the individual members which would naturally force out the older members just at a time their insurance was perhaps most needed. Consequently, such associations have attempted the more popular method of averaging the costs, which in an association comparatively recently formed might not be particularly objection-

able at the start, but here again we find the same fallacy to which assessment insurance is subject. As a method of procedure, the insurance affairs of such an association are generally referred to a special committee for investigation and report. The report being made, the acceptance of the proposed plan is subject to a majority vote of all the members. It will be readily seen that a majority vote in favor of such a plan outlined will not necessarily bind any individual member who still has recourse to resignation, so that even if an insurance company considered the issuance of insurance on individual Term policies on the members of an association the probabilities are that the composition of its membership would immediately change if the proposition were put across. In other words, the insurance company would immediately expose itself to a certain selection.

I believe that most companies have rightly refrained from considering this class of business on the general principle that the company should not lend itself to the issuance of any plan of insurance which in the end is doomed to failure, for any possible profits accruing to the insurance company would be far outweighed by the disappointments which must result.

On the other hand, such associations offer a possible field for individual business provided the fallacy of attempting a group coverage can be properly made clear to the association, for the reason that there is no average need of insurance within such group beyond a possible burial benefit. If this fact can be brought home strongly to the individual members of the association, individual insurances may be written in the usual manner.

The ramifications of bulk or wholesale insurance are many and have not necessarily been listed hereunder. As earlier suggested, it has been the writer's purpose to point out in the main the principal cases which involve bulk or wholesale insurance, with the reasons therefor, and the differences involved as against the principal business on the company's books because of individual solicitation. Most of these are of comparatively recent origin and the problems involved may perhaps be unfamiliar to certain of our members. One should clearly bear in mind in all this discussion the fundamental differences which distinguish bulk or wholesale insurance from the ordinary business of individual solicitation, and that perhaps this general deduction may be made, that it is poor business to

issue any group, blanket, bulk, or wholesale insurance in such a way as to make inroads thereby on the field of individual insurance. In other words, there must be some underlying special or common reason for the establishment of the bulk or wholesale insurance idea in addition to insurance on an individual for his own protection, that is, the protection of his family. Bulk or wholesale insurance cannot in itself solve the insurance question for the individual for the reason that the insurance needs of the individual cannot be expressed by a common formula. Group, wholesale, or bulk insurance is therefore supplemental to the regular life insurance field. If this principle is carried out in these ideas, the whole field of life insurance will be broadened. The recent adoption of the wholesale or bulk insurance idea is an indication of the possible development of life insurance in the near future worthy of our consideration.

Discussion of Preceding Paper.

(WRITTEN DISCUSSION.)

MR. PERCY H. EVANS:

I think Mr. Morris is right in saying that wholesale insurance has introduced some new ideas. For example, some time ago we were presented with a plan to secure legislative authority for funding bonded indebtedness by insurance on a population making the particular political subdivision the beneficiary, premiums to be met by special taxation, a proposal surely the ne plus ultra in group insurance.

Mr. Morris seems to have been anxious to support the opinion that wholesale insurance will be merely supplementary to and not in competition with individual insurance as now practised. I venture to doubt this, believing that in the long run the cost of all group insurance and pension benefits falls upon the beneficiaries. The social advantages come from the element of compulsion, more or less direct. If, to use a popular agency expression, every citizen were thoroughly sold on the necessity of individual insurance and thrift, wholesale insurance would not be thought of. If we cannot get at the individual directly let us by all means get to him through his employer regardless of what the latter's motives may be. Whether individualism or group action will produce the best social results, the better type of citizenship is perhaps immaterial. Half a loaf is better than none. Many men learned to value life insurance through fraternal benefit orders. Group insurance may show similar educational results.

Excluding for the moment wholesale yearly term insurance covering groups so large that the insurance company's function is chiefly that of a disbursing agent for the employer and the transaction is insurance in name only, it seems to me that the influence of wholesale term insurance on individual insurance may be greater than is presently expected. It would be unscientific to theorize about possible changes in existing practice until the problems are much more clearly defined than they now are. It is sufficient to remark that there is nothing inherently sacred in old established ways. Changes may be the price of survival however unpleasant they may be. I note with interest Mr. Morris's defense of savings bank and insurance combinations by saying in effect that the underlying principle of life insurance companies is to sell insurance protection and not investment. Life insurance started with temporary insurance; it then passed to the whole life contract. Later the limited payment life and the endowment plans were added with various additions designed to appeal to the thrift instinct. Much of the insurance placed twenty years ago was sold on the investment argument. These policies are today the feeding ground of the twister who has not been slow to take advantage of the argument furnished by the high prevailing interest rates in which established companies can share only as to their new investments. Habit will lead a man to deposit in commercial banks at no interest or in savings banks at small interest, yet he will often show dissatisfaction with anything materially less than current rates on a transaction he has come to regard as an investment and more so of course when there is a considerable expense element. As Mr. Morris says, we do not issue many ten-year endowments. The reason for this is so plain as to require no comment. Some of the thrift plans outlined by Mr. Morris suggest either radical changes in the method of handling high-priced contracts or their eventual disappearance in favor of ordinary life and other low premium endowments with an educated demand for convertible term insurance that will be converted only when the insured finds himself no longer a standard risk.

MR. J. H. WOODWARD:

Mr. Morris's paper reads like a description of a day in an experimental laboratory. In addition to group insurance along the conventional lines,—which may be considered to have established itself as a permanent and highly successful branch of the business,—no less than seven special uses or means of securing life insurance, all of which are still in the experimental stage, are brought to our attention. Any one of these topics might readily yield sufficient interesting material to fill a paper by itself. In discussing Mr. Morris's paper, therefore, about all that can be done is to select a few salient points out of the almost innumerable ones which suggest themselves.

The Small Employer Group.—What Mr. Morris calls the "Small Employer Group," is one which includes less than fifty employees. After pointing out that the legal definition of group insurance precludes the issue of group contracts where there are less than fifty employees, Mr. Morris tells us that it has been essential to devise some plan for issuing wholesale insurance on the employees of the small employer. The natural implication is that, as stone walls do not a prison make, so a statutory definition cannot prevent the spread of a good idea. Assuming that it is good underwriting to issue group insurance where there are less than fifty employees, two courses are open: (1) to seek amendment of the statute; (2) to find some way of accomplishing the same thing without violating the statute. At the time the statutory definition was framed, the limiting number of employees—fifty—was doubtless a more or less arbitrary choice. It would be difficult to show that the best interests of either the public or the companies would be endangered if twenty-five were substituted for fifty in the legal definition.

The issue, directly to each employee, of one-year renewable term contracts for adjustable insurance provides coverage which is practically identical with that granted under a regular group contract. although the means of providing it is in many respects awkward and inconvenient. The only important difference between one of these arrangements and a regular group policy is the fact pointed out by Mr. Morris that the rates of premium are somewhat higher in order to avoid discrimination as compared with the company's regular contracts. That this scheme for issuing wholesale insurance on the term plan to employers who cannot qualify for group insurance is a permanent addition to life insurance practice seems open to doubt. If it proves unsuccessful, it will indicate that the present statutory rule was probably well-considered: if it proves successful, it means that the definition should be amended.

Co-operation of the Employer in Obtaining Insurance for his Employees.—Mr. Morris next discusses the possibilities of supplementary insurance on the lives of employees in addition to or as a substitute for group insurance, such insurance being on regular forms of contract and subject to the usual medical and other underwriting requirements. The problem of staff insurance as distinguished from group insurance has been given considerable attention in England but very little has been done with it in this country. The dividing line between business thus obtained and that secured through ordinary solicitation is not a very distinct one, although in two respects it may often be differentiated: (1) the deduction of the premium from the monthly or weekly pay, the employer acting as a collecting agency; and (2) the waiver of medical examination.

Some employers who appreciate how desirable it is that their employees should carry life insurance beyond that provided by the

company's group insurance plan, are willing to permit, under proper regulations, a solicitation of the employees for additional insurance during working hours. This has many advantages because the agent then approaches an employee already insured under a group contract and he approaches him with the express or implied endorsement of the employer. Furthermore, he finds all his prospects together at one time and in one place.

Mr. Morris emphasizes the importance of an arrangement under which the employee executes an allotment of a certain amount out of his weekly or monthly wages which the employer undertakes to pay over to the insurance company. This makes it possible for the employee to pay for his insurance weekly or monthly according to the basis on which his wages are paid, and, since the money for the premiums never actually comes into his possession, thrift is made easier and the business more persistent.

One of the disadvantages of supplementary insurance schemes is the fact that unless the matter is presented to the employer with great discrimination, it may confuse rather than clarify the group insurance issue and make it more difficult to secure the carrying of a reasonable amount of group insurance. Supplementary schemes are by their nature contributory and voluntary. Hence they are in practice unsatisfactory as compared with group insurance paid for by the employer, because of the difficulty of bringing about a general participation in the scheme.

Home Building or Housing Contracts.—Mr. Morris draws attention to a new and very interesting type of blanket policy to provide life insurance in connection with home building projects. There has long been a demand for some form of blanket insurance which would insure the life of the borrower under any arrangement where a loan is repayable by instalments for an amount equal to the balance of the debt outstanding at the time of death. The first difficulty met with in such cases is that of arranging a satisfactory plan except where a medical examination is required. Another difficulty is that of keeping track of the varying amounts of insurance from year to year. No two plans are likely to have the same amortization schedule, with the result that the accounting with varying amounts of insurance and varying premiums becomes very complicated. Finally, since we are dealing with decreasing term insurance, the premiums are likely to be small and the proportionate cost of handling the business high, especially when it is considered that the instalments of the loan and therefore the premiums, are generally payable monthly.

A simpler plan for meeting such situations might be to issue term insurance contracts for level amounts to be assigned to the lender as his interest may appear and with a special conversion privilege enabling the borrower to convert to a permanent plan of insurance at the time when the loan is finally paid off. At that time he wi l be relieved of the necessity of paying further

instalments on his loan and will be in a position to undertake the larger payments necessary under the permanent insurance.

Group Annuity Contracts.—The problem of issuing a blanket annuity contract to industrial pensioners who have already reached the retirement age is an important one although it will of course be recognized that it is but a small part of the general problem of pensions for industrial employees. The principal difficulty hitherto experienced in issuing annuities on the lives of pensioners has been that the ordinary rates charged for annuities seem to the employer to be too high. Mr. Morris points out that, because of the absence of individual selection, a company can afford to grant annuities at somewhat lower rates in such cases than would be charged to individual annuitants. As a general principle this appears to be true but it is not clear to what extent it is true or what are the best means of taking this fact into account.

It is pointed out in the paper that the chief difficulty in all pension calculations is the withdrawal rate. This is indeed the factor which is the principal obstacle to devising pension plans which may be carried by insurance companies. It is beginning to be recognized, however, that under modern conditions an industrial pension is in the nature of a deferred wage and that there should be no forfeiture of the employee's equity on resignation or dismissal. If the employee's right to the pension is made contractual and he is given the ownership of a contract which shows from year to year how his savings fund is increasing, he is then able to see for himself that the pension plan offered by his employer serves just as effectively to increase his wages as though the money had been paid into a savings bank on his behalf. It would appear that the best method of attacking the industrial pension problem generally is through education as to the advantages of the money-purchase plan. The problem of the labor turnover can be met by providing a probationary period of several years which will serve to exclude entirely from the operation of the plan casual and migratory workers and others who are not likely to persist in the employment.

Utilizing the Thrift Idea in Insurance Purchase.—As an example of the use of insurance as a subordinate feature in connection with thrift schemes, Mr. Morris outlines the essential points involved in insuring deposits in savings banks, the fundamental idea of all such plans being to provide in the event of premature death an amount at least equal to the so-called savings objective. Savings bank insurance schemes of this sort are not especially new. The plan has been tried in one form or another for at least four or five years. Three plans of insurance have been used in connection with these schemes: (1) decreasing term insurance for the difference between the amount of the accumulated savings and the savings objective; (2) straight term insurance for the full amount of the savings objective; (3) ordinary life insurance. The plan

has also been tried in connection with accident insurance. From the point of view of the insurance company, the ordinary life contract is perhaps the most satisfactory plan to use, as it not only avoids the necessity of getting out special policy forms but it also insures that in a good many cases the insurance will be permanent. One possible objection to the ordinary life plan is the danger of a rather severe selection against the insurance company at the end of the savings period.

The most important problems involved in such schemes, however, are sales problems rather than actuarial ones. From the standpoint of the bank, such plans make strong appeal: it is easy to sell banks the idea. From the standpoint of the insurance company, the premiums are quite small, especially under the decreasing term plan, the amount of office detail is considerable, and the possibility of agency complications is not to be overlooked. To offset these considerations is the fact that most of the work of getting the accounts should be assumed by the bank, which should also assume the expense of any advertising campaign which may be undertaken. Experience will ultimately show whether business can be secured in this way both for the bank and the insurance company in substantial volume and cheaper than under the more usual methods of obtaining it. Up to the present, experiments with the plan have not demonstrated that this is true, and it is probable that a conclusive answer cannot be reached until experiments have been conducted over a longer period, especially one not marked by extreme business depression. One point, however, stands out quite clearly. If the plan is to prove successful the bank installing it must be prepared to undertake an intelligent, energetic and continuous campaign for bringing in these accounts and such a campaign must be organized on a sufficient scale to make it pay. Savings bank insurance may prove to be a successful and permanent development but it is not a philosopher's stone. It does not do away with the time-honored principle that life insurance must be energetically canvassed for if it is to be placed on the books. The peculiar possibilities of the plan lie in the fact that it may shift the burden of making the canvass from the insurance company to the bank.

The Raising of Endowments.—The paper then goes on to describe the use of endowment policies in connection with the raising of funds by college classes for the benefit of the college and by college fraternities for the purpose of paying for fraternity houses. Mr. Morris says: "In the writer's judgment the issuance of small endowment policies, the premiums on which are to be paid individually, is open to certain objections because of the possible lapse and consequent failure in the realization of the endowment. Consequently, it is suggested in such cases that insurance policies to the extent of the proposed endowment be taken out on a few members of the group. For example, if $50,000 is

to be raised, ten members of the group should be insured under ten policies of $5,000 each." It is quite true that if the premiums on small endowment policies are to be paid directly by the individual members of the class there would be considerable danger of lapse. If, on the other hand, the premiums are paid through the class secretary, the policies having been issued to the class organization on an ownership form, or absolutely assigned to it, there would be relatively little danger of lapse, as in such case the delinquent members are carried along by the organization as a whole. In order that the premiums may be paid by the class organization rather than by the members individually, it is not necessary that the lives insured should be limited to a few selected persons. Indeed, it would appear that such an arrangement would be tainted by a speculative element and might be considered to some extent a perversion of the proper uses of life insurance. The overhead expense is of course somewhat higher where a number of small endowment policies are issued in place of a few large ones. On the other hand, the speculative element is thus avoided and it is also possible to issue the entire group without medical examination provided substantially all of the class enter the scheme. The same observations apply to arrangements for insuring members of college fraternities.

One reason why these schemes appeal to college classes as distinguished from a plan whereby the arrangement is financed simply through the accumulation of the class dues, is because class organizations are generally loosely constituted and have no permanent employees or paid secretary. Where the scheme is arranged through an insurance company, its operation is made automatic and financially certain, with little responsibility for the handling of funds by the class officers. Most of these plans differ essentially from the more usual schemes for bequest insurance in that, as has been pointed out, the premium is generally paid by the class organization, or, in the case of a fraternity, by the central organization, rather than directly by the individuals insured.

Non-Employer Associations.—The subject of non-employer associations, the last of the particular applications of wholesale insurance mentioned by Mr. Morris, is one which frequently arises in practice. He has so fully set forth the dangers which lurk in this field that there seems to be little to be added to his comment. It is well to emphasize the fact that the insuring of non-employer associations is liable to all of the dangers which the history of assessment and fraternal insurance have served to make plain. With that history at the disposal of underwriters, it is not to be expected that the mistakes which have marked the development of assessment insurance are likely to be repeated.

There are two essential differences between an employer group and the typical non-employer group. First, in an employer group

the relationship of the individual to the group is predicated upon a motive far more powerful than the desire to secure life insurance: the life insurance is an entirely subordinate feature in the arrangement. Second, in most employer groups, the premiums are paid entirely by the employer: to the extent, indeed, to which the group is contributory, it becomes exposed to the dangers of assessmentism.

There are groups which are non-employer groups and where, nevertheless, the group is brought together and kept together by influences which the cost of the insurance contract cannot affect. Mr. Morris cites as an example an association of the purchasing agents of manufacturers all engaged in the same line of business. Another example would be the members of a stock exchange where each member pays a substantial sum for his seat. In fact, almost any association formed for some purpose entirely apart from the securing of insurance might safely be insured as a group for small amounts. But every non-employer association which has been formed especially for the purpose of securing insurance, or where the securing of insurance is one of its primary purposes, should be regarded as uninsurable on the wholesale plan except on the basis of individual contracts of ordinary life insurance with such leniency as to medical requirements as the proportion of the membership to be insured to the total membership would indicate to be warranted.

As a whole, Mr. Morris's paper is a record of progressive achievement, of a striving to amplify and perfect the service which the institution of life insurance is rendering to the community.

MR. A. D. WATSON:

The fundamental problem, ideally stated, of which a solution is attempted through the agency of life insurance is that of entirely filling, so far as material things are concerned, the place left by a deceased member of Society in relation to his dependents, associates and friends.

That Society, as presently constituted, or as it is likely to be constituted so long as human nature is what it is, will ever approach this ideal with any more discriminating precision than that with which it clothes, houses and feeds the individual, is extremely doubtful. Insurance companies have afforded one of the principal means by which the requirements of Society in this regard have, in a measure, been met, and, as pointed out in the first paragraph of the paper, mainly by companies employing soliciting agents. But the more modest achievements of companies following other methods, and of combinations of individuals not usually designated as companies, are none the less commendable. In particular we should not forget the future possibilities of friendly societies, large and small, with their special appeal to

persons of one race, of one religion, of one occupation, or, in some cases, to the fraternal instincts of the public in general. Many of these societies are now doing business in a sound and safe manner, and in a few years more of them will be doing likewise. They may, therefore, be expected to contribute in a substantial way to the solution of the fundamental problem above stated.

Mr. Morris, in his paper, shows that old line companies are not necessarily limited to the traditional method of individual solicitation in making their contribution to the solution of the fundamental problem; but his paper is replete with evidences of the manner in which they have been hampered and hindered by reason of certain statutory requirements. He states the definition of group insurance is not perfect; "that data are still too inadequate to prove whether 50, 100, 250 or any other number is the magic boundary line below which medical examination must be required for the safety of the insurance company, although we do know that the mortality which the companies have experienced on the smaller group cases has been fully as favourable as on the more moderate sized groups." The above opinion, based on at least some few years' experience, seems to be full and striking proof of the futility of attempting to lay down in advance, by rigid legislative enactment, rules as to business details, with any hope that they will prove sufficiently flexible to satisfy business needs.

The initial mistake seems to have been made when the requirement of a medical examination for life insurance was embodied in some statute; for, if this and possibly some other undesirable enactments had not been made, there would have been, it would seem, no real impediment to an employer providing insurance on any one or more of his employees, payable to beneficiaries designated by the life insured; and the need for enabling legislation for group insurance, with the opportunity for further restrictive enactments, would not have arisen. In any case it seems quite certain the legislation in regard thereto would have been materially different, and probably less crippling, were it not conditioned by earlier inept enactments in regard to medical examination and other matters; and this suggests what has perhaps often occurred to each of us, that legislation as to business details, however carefully drawn and however beautiful and attractive in theory, will almost certainly be found in practice to contain ineptitudes necessitating further legislation, in turn containing other ineptitudes; and so the game goes on, reminding one of Mr. Wells's description of the game of chess between the Almighty and Satan in the prelude to "The Undying Fire."

The problem of selecting and grading risks lies at the very foundations of life insurance; but it is not obvious in what way companies are aided by the rigid requirements of so indefinite a desideratum as a medical examination in the selection of individ-

ual risks, nor, in the selection of group risks, by the rather irrelevant limitation (minimum) to fifty employees of one employer, all of whom may in one case be sitting on a powder magazine; in another they may be engaged in a most healthful and safe occupation. It is clear, the selection of risks is a business problem, not an exact science, and detail of method should be determined by what is deemed essential and necessary in each case, by those responsible for the business, in the light of the knowledge and experience available. A company might, while strictly observing the statutory requisitions as to medical examination, as to group insurance, and as to many other matters, go straightway to damnation; and, make what rules and restrictions we will, the foundations on which we must rely, in the ultimate analysis, are the wisdom, the skill, and the business sense and judgment of those responsible for the safe guidance of companies. Is it not obvious that that reliance should be placed on the same foundations without the hampering restrictions? Mr. Morris indirectly points to this better way of settling business details, in the third paragraph of his paper, where he states: "The fact that group life insurance has developed along such substantial lines, as has been the case, is in my opinion to a considerable extent due to the fact that the actuaries of companies which are interested in group insurance development have met informally to discuss their common problems so as to avoid the mistakes which might otherwise have developed had each company treated the subject independently." This is the only method of regulation which has prevailed in countries not having any group insurance legislation, and no dire results seem to have followed; but if the results have not been entirely satisfactory the method indicated by Mr. Morris can be further resorted to. If it should fail it is doubtful if legislation can remedy the situation. But if it can, by reason of past experience, it can be seen in what respects its aid would be most efficacious and least harmful.

After giving illustrative cases in which insurance cannot be written by reason of the group definition, Mr. Morris states the illustrations "suggest a possible broadening of the definition in such a way as to include business in which manifestly there is no selection as far as any individual or any group of individuals is concerned."

The only practical way to proceed in the circumstances may, unfortunately, be by seeking a broadening of the definition; but, whether intended or not, the evidences in the paper seem rather to suggest that the whole definition and its limitations should, and might safely, be eliminated. Companies would then be free to furnish insurance to individuals or to groups of individuals, taking such precautions as the exigencies of each case might demand; and thus the group method or any other method, of contributing, in however limited a degree, to the solution of the fundamental prob-

lem, would be allowed to find its true place, even though admittedly ancillary, in the main scheme of life insurance. It seems hardly more creditable that needed protection should be denied any one by reason of some inept definition or requirement than that in a great and rich country the hungry should go unfed by reason of reverence for some theory, however beautiful in the abstract, as to the proper constitution of Society. Insurance business is, and can be, carried on under severe and inappropriate restrictions, but, in the main, the people pay the price and even then may be denied the protection they need. There must of course be insurance legislation, but it should at least stop short of attempting to substitute legislative sagacity and judgment for business sagacity and judgment. Mr. Morris's paper should, by implication, do much in the way of inducing wholesome views as to the proper limits of insurance legislation.

MR. W. I. KING:

Mr. Morris has done well to call to the attention of the Society some of the special underwriting rules or principles involved in the development of what might be called a new order of social insurance. All of the insurance forms mentioned in his paper apply the principles of insurance in the solution of economic problems. These principles are applied, in most cases, for the benefit of a number of people en masse, and in many instances at the expense of a second party, whose sole benefit derived therefrom comes from the improvements which are bound to follow any development of the social order to a higher plane.

Any study of the underwriting principles applicable to the application of insurance principles to mass insurance is worthy of careful consideration, and can be best studied in the underwriting of group life insurance.

Group life insurance as written by many of the companies at the present time is that form of insurance which is described under the laws of the State of New York as group life insurance. In addition to the peculiar features herein outlined, as shown in Mr. Morris's paper, there are two other restrictions to which it is desirable to call your attention. The first is that group insurance must cover all the employees of a certain class or classes of the employees of any individual employer as determined by conditions pertaining to employment; the second is that the beneficiary must be someone other than the employer.

We find, then, by its legal definition that group life insurance is employees' insurance written under two different conditions:

1. Where the employer pays the entire premium,

2. Where there is a joint contribution by employer and employee in payment of the premium.

Under the first plan we have what may be considered the typi-

cal conditions surrounding mass insurance in its most extended form. It is this that I wish to study.

The most important thing to note is that the insurance covers only the employees of an individual employer. This means that with a few exceptions in the conception of the risk the insurance company covers only those employees who are working for full time and for full pay, and has, therefore, the benefit of a selection analogous to the medical selection on individual risks. But it means much more than this. *It means that in the typical case the individual is covered for insurance only while he is an employee of the specified employer* and that for the present, at any rate, the insurance companies are experiencing only a fraction of the total number of deaths that eventually occur among the total number of employees exposed on account of their passing out of the experience at termination of employment. It is true that these employees have a contract right to convert their insurance at the termination of their employment, but for the present, at least, they are not educated to the point of exercising this option. To me, this one fact influences the group mortality rate more than any one thing. Let us assume that personal selection was eliminated and every employer carried group insurance so that at the termination of the employment of any employee his insurance was carried on under some other contract, wouldn't our mortality rate approximate that shown by population statistics? We can look forward to a gradual increase in the rates charged for group insurance, as it more and more fulfills its true function. In the meantime we mustn't overlook this point in our underwriting.

The second thing of importance to note is the absolute elimination of any selection, either as to the fact of the insurance or as to the conditions surrounding the insurance on the part of the individual covered. His duties lie solely in receiving its benefits.

The employer decides to give his employees insurance—he cannot be made the beneficiary of this insurance—so there can be no ulterior motive in this decision that would make for an unfavorable mortality. He decides upon the plan of the insurance he will give these employees and the amount each one will receive, but in all these decisions there can be no element of selection detrimental to the insurance company. Group insurance must be written upon some plan that will eliminate individual selection. This, then, is its second great characteristic.

Lastly, it must be written upon a number sufficiently large so that an intimate knowledge of individual employees on the part of the employer will not influence him in his decision to carry group insurance or make it financially profitable for him to cover all his employees in order to obtain protection for a few bad risks. Whether this be fifty or not is a matter of personal opinion, but this, I believe, was the intent back of the law in naming a minimum number that could be covered by group insurance.

These are the three chief features that in my opinion differentiate group insurance underwriting from individual underwriting, and to a great extent account for its present mortality rate. How often do we find it intimated that the low rate charged in group insurance is due to the favorable mortality found in mass insurance and the curtailing of expenses in covering a great number under a blanket contract! Among the above factors, however, one only is influenced by the numbers insured and that only to the extent of making a consummate knowledge of the physical condition of individual employees impossible.

How much more potent the other factors are in their effect upon mortality is shown in the mortality rate in the second class allowed by law under group insurance—or in the so-called contributory group. Here the employer determines the fact that group insurance will be placed upon the employees in his plant. He usually determines the form and amount of insurance to be placed on each class of employees, but if not, the plan of insurance adopted of necessity precludes individual selection. It is recognized, however, that if the individual employee is to pay for any share of the cost of the insurance he must have the right to say whether he will be covered at all or not, and to that extent exercise an individual selection. The law simply attempts to say that if this individual selection exists, seventy-five per cent. of the eligible employees must be covered on the theory, I presume, that so large a percentage will eliminate any adverse selection against the insurance company.

But what is the result on our mortality experience? As pointed out by Mr. Morris, the mortality rate on contributory cases is 33 1/3 per cent. higher than that on the non-contributory cases. In fact, this rate increases in direct ratio to the portion of premium paid by the employee. This result only adds further proof that our mortality rate is not a bulk mortality rate but one governed, I believe, by the influences which are above enumerated.

It was unfortunate that the name "group insurance" was adopted for this form of insurance, as the name leads many to form erroneous ideas in regard to its characteristics, and is liable, therefore, to lead some companies into grievous ways unless they are properly guided.

I think that it has unconsciously led Mr. Morris to quarrel with its definition when he would cover an association of employers by group insurance if the law didn't prevent him. I am not saying that they are not entitled to insurance or that they have not an economic problem that can be solved by insurance principles, but as Mr. Morris points out that contributory cases are not entitled to the same rate as employer cases, so I believe that Association of Employers wouldn't be entitled to the same rate as the individual employer, because in the Association case you would broaden your field of coverage and thus increase the percentage

of death claims to the number exposed to risk. Again, in the Association of Purchasing Agents which he mentions there would be little or no labor turnover, and consequently there would be a material increase in mortality and they would not be entitled to the favorable rate given the typical group case.

Seeing what looks to me to be erroneous conclusions drawn with regard to group insurance on account of its very name I regret to see what looks like a more or less general adoption of the word "Wholesale" insurance to apply to such form of insurance written in bulk form that cannot be written on the group plan under the law. "Wholesale" insurance as used in this paper and as becoming generally adopted applies to insurance written in bulk, that cannot be written on the group plan, but which is surrounded by such restrictions as will eliminate adverse selection against the company. In no sense is the insurance sold in wholesale in the generally accepted meaning of the word and its continued use is apt to lead to misconceptions as they now exist in regard to group insurance.

We are accustomed to think of the savings in expenses that can be effected in selling insurance in bulk. The chief of these savings is effected by the reduction made in acquisition cost, especially in the commission paid to the agents. This saving may amount to between 5 and 10 per cent. of the gross premium, but no more. I have been unable to discover any other reduction in expenses under group insurance as written at the present time.

The initial cost of preparing the data and issuing the individual certificates is quite as expensive as issuing policies on individual lives. Mr. Morris has pointed out that on the contributory cases the insurance company has the expense of keeping these employees sold to the idea so they will continue their contribution. We have the same condition, only more exaggerated, in the non-contributory case. Here the employee has never been sold the insurance idea, and in many instances does not even understand it. No employer can obtain full benefit from money expended if this condition is allowed to exist, and we find the insurance companies offering such extraneous service as welfare literature, industrial surveys, etc., etc., with the ultimate end in view of furnishing service that will spread the idea of group insurance and keep the contract sold. This service all costs money, and when taken into consideration, makes the ultimate cost of group insurance not much less than that of ordinary business. Few companies can conduct their group business at the present time on less than 22 per cent. of the gross premiums, provided they charge to group insurance all of these extraneous expenses which they incur.

The ultimate cost of this insurance, however, is not so important as is the fact that the insurance companies must return value for money received. This can readily be done and a con-

tinuation of the study of the problems brought out in Mr. Morris's paper is worthy of our best efforts.

(ORAL DISCUSSION.)

MR. J. F. LITTLE:

I had prepared nothing to say on this subject, but I have made a few notes during the discussion and would like to mention a few points. In speaking of the insurance of associations, Mr. Morris says: "Under the definition of group insurance an association of the employees of a common employer might under certain circumstances be insured under a group policy, *i.e.*, if 75 per cent. of all employees eligible were insured; and the insurance companies writing group insurance have had more or less of such cases presented." There is one point that is sometimes overlooked in connection with associations. The association comes to a life insurance company as constituting, say, 80 per cent. of the employees and it is immediately supposed that, as 75 per cent. will thus be covered, that is all that is necessary to be done, but the law provides that the insurance shall be offered to all employees and you cannot legally offer it to merely 80 per cent. The law requires all to have the opportunity of coming in if the insurance is to be placed, and the company writing that insurance must find out how to collect premiums from any of the outside 20 per cent. who may accept the offer. The chief difficulty with associations, where the association has to pay the whole premium, is this: if the association on the one hand charges a flat rate of premium for all its members, it is very apt to find that the younger members or new employees will look askance at the scheme, should they find that they can get individual insurance at a lower rate, and, in any event, they will want to know why they should pay as much as the older employees. On the other hand, if the association tries to collect from each individual his ascending premium, in the process of time men get older and older, and the premium rises every year until it reaches such a height that many will refuse to continue paying their premiums and there exists no means of compelling them to pay. Provision to cancel the policy unless those once insured all continue while in the employer's service is an unsatisfactory arrangement, as no company would like to issue a policy looking forward to cancelling it because a certain number of persons drop out. The insuring of associations, therefore, where the members provide all the premiums is very unsatisfactory, and I think nearly all companies writing such insurance now insist that the employer pay a large fraction of the premium out of his own pocket,—say 40 per cent. Of course, the same conditions would apply if all the employees instead of 75 per cent. were insured, unless the employer paid a considerable part of the premium. There is a plan that has been worked in some

cases—in one instance the employer charged each person $4.00 per thousand of insurance irrespective of age. Where the employer pays the balance of the premium over a uniform rate, there is no ascending premium for the employee to handle, and that form is, I think, free from objection.

Mr. Evans said that he doubted whether the group insurance would prove to be extra insurance, in other words, whether it would not prove to be largely in lieu of individual insurance. The employee ultimately pays the premium himself—I think we all admit that—but it does not follow that he will devote just so much less to individual insurance on his own account. Mr. Evans's plan is "to completely sell the individual to the insurance idea," and then he will take sufficient insurance on his own account. If we could completely sell the insurance idea, all that would be true, and I think the rest of the problem would be easy. But we must take men as they are, and on the average they are far from being "completely sold."

Maintaining group insurance is a social service for two reasons. A certain number of individuals could not otherwise insure at all, or could get insurance only with much difficulty, on account of various impairments; and a second class will not insure,—the careless, indifferent, selfish type who will not make protection for their families, but whose families need protection as much as, and often more than, others. We get these two classes insured under the Group plan and we are rendering to the community as a whole an important service in Group insurance, and that to my mind is the best reason for any company entering on the business.

I think Mr. Evans touched on such forms of insurance as the 10-year endowment and suggested that in the future we might get away from them. We all realize that the ordinary 10-year endowment is rather an expensive proposition. But we must remember this: there is a type that can be induced to save money if the demand for saving is periodic and has a good deal of compulsion back of it, but who would not save if there were no compulsion. A 10-year endowment is a little expensive, of course, owing to the difficulty of handling this small fraction of our business on a special basis and it is true that the 10-year endowment is subject to rather high expense. In the future, we may be able to do something to improve the situation, but I do not think we are liable to drop the issuance of such policies. We might commence selling a 10-year endowment somewhat modified in the shape of a savings policy.

With regard to the plan to deposit a fixed monthly instalment to accumulate a thousand dollars at the end of ten years, and to combine therewith a decreasing term insurance (which no company now will grant) or a regular 10-year term insurance, or, in some cases, whole life insurance, there is one point concerning it with which I do not feel entirely satisfied. Those of you who

have read the literature put out by the banks will find it is presented as a joint undertaking of the bank and the life insurance company. Now, if the bank should get into difficulties—and they do occasionally get into difficulties through defalcations, etc.,—and if the bank should be unable to pay, the effect on the insurance company's good name would, I think, be a serious matter—and that to my mind is the most serious feature of the combination transaction.

I find I didn't succeed last night in our little Group meeting in convincing Mr. King in a certain matter. Mr. King made the point that one reason why group insurance mortality has been satisfactorily low is because so many employees leave the employ, and he contends that the average vitality of those who leave is considerably less than that of those who replace them. However, if we take some occupations, street car conductors, for instance, the reverse is true. Many take up such outdoor occupations because they are threatened with tuberculosis. These departing employees must have some occupation when they drift out of their present employment, and if they drift into lighter tasks we will still have them as we do not refuse to take those employed in the lighter occupations for group insurance.

The employers who take this insurance are the high class employers who take an interest in their employees' welfare, and that is why, in my opinion, we are having a low mortality. This explains another point of Mr. King's when he says that contributory group insurance shows an unsatisfactory mortality. You will remember that he quoted the contributory groups as showing a mortality 33 per cent. above the non-contributory. Now, if all this extra were due to insuring part only of the employees as is usual under the contributory plan, as 75 per cent. of the employees are included on an extra mortality of 33 per cent. on 75 per cent. of the employees who would give us 100 per cent. of the mortality for the total employees, it would follow that the remaining 25 per cent. of the employees experienced no mortality whatever. The true reason appears to lie in the fact that the employer under the contributory scheme is often of a poorer class than under the non-contributory plan.

MR. WILLIAM BREIBY:

I merely wish to make some remarks pertaining to the last part of Mr. Morris's paper where he refers to "Non-Employer Associations." As Mr. Morris states, he did not attempt to list the various possible or typical cases. There is a type, however, which his remarks hardly cover and to which Mr. Woodward referred, viz.: where the insurance feature is subordinate to the other features of membership in the organization; and in which the insurance feature alone would hardly induce continuance of membership, because the membership is bound by other powerful ties of common

interest. Mr. Woodward cites the case of the members of a stock exchange. Similar in type would be a national labor organization. This case differs from that cited by Mr. Woodward, however, in that the membership is much larger, is spread over a wider territory, is of the industrial class, and the individual amounts of insurance would be smaller.

Many present probably heard of the plan proposed some months ago by which one of the large national labor organizations planned to cover its members for insurance of $500 each, the "union" to collect a uniform rate from its members of $0.50 per month, per $500 insurance, and in turn to insure the group, or reinsure the group, in an insurance company, and pay quarterly the one-year term rates according to the ages of the insured members. It was at first intended to make this insurance compulsory with membership, but owing to industrial conditions it was deemed inadvisable for the "union" to attempt to make it compulsory. The insurance proposition was presented to the members on an elective basis.

The rate of $0.50 per member ($500 insurance) to be collected by the "union" was based on the average age of the members as determined by representatives of the "union," and was intended to cover the average rate to be paid to the insuring company, with a margin of a few cents to defray the "union's" expenses in handling this insurance feature. However, the average premium-effective age of the members who sent in "information cards," indicating that they would be interested in the insurance, proved to be about 5 or 6 years greater than the average age at first supplied by the "union." It almost goes without saying that the average premium-effective age of those who would finally accept the insurance would be still higher. In fact, I have learned that the average premium-effective age of those who finally accepted the insurance was nearly 6 years greater than the average premium-effective age of those who indicated that they would be interested in the insurance, even though all over age 60 were excluded in deriving both averages; also that, whereas about 25 per cent. of the members supplied "information cards" only about 10 per cent. of the total membership finally took the insurance. This shows the care which must be exercised in quoting average rates or probable total costs for an elective plan.

Assuming that there are no legal obstacles in the way of effecting such "group" or "bulk" "reinsurance," I think an insurance arrangement can be made which would be safe for the insuring company and of service to the labor organization and its insured members, though not on a compulsory plan. I also believe it would be entirely proper for a stock life insurance company to assume the risk, though the amount of insurance on its books prior to the insurance of so large a group was only a comparatively small fraction of the amount of such group (a possible

100,000 lives), if the company had a large capital and was able, under its contract of insurance, to exercise some selection of individual risks. The company would thereby be increasing its insured membership, conceded to be desirable when not done at excessive cost, and the insuring of so large a group would not adversely affect the service to, or the security for, the other policyholders. There is no "catastrophe" hazard involved. The insurance arrangement in the case above mentioned was to be on a nonrenewable one-year term plan. Though it was expected that the insurance contract would be continued from year to year, the directors of the company wanted to be assured in advance that if it were to be on the risk for one year only it would earn money on the case in that year. This could be assured by exercising selection (not necessarily by medical examination) of the individual insured members and by charging sufficiently high rates. The purpose of a stock company is to earn money for its stockholders, and in return the company renders service.

The company which I represented was not successful in placing this insurance, because of insistence upon conditions which were considered essential. The insurance was placed, however, in another small stock company, and, I understand, on conditions not as stringent as we thought necessary. I am sorry to say that I have not been able to learn how this company has fared with this group.

(AUTHOR'S REVIEW OF DISCUSSION.)

MR. E. B. MORRIS:

The author's primary purpose in this paper was to introduce before the Society for discussion certain new subjects of comparatively recent development, out-growths mainly of group insurance. It is gratifying, therefore, that the discussions which have resulted have involved so many different angles. It was not the author's purpose to argue either for or against the various problems enumerated, beyond the statement of certain underwriting principles which he believed important.

From this point of view there is little that need be added in reviewing the comments which have been made.

Mr. Woodward has particularly elaborated upon quite a few of these subjects and to good purpose. In the discussion of the raising of endowments, he suggests that the arrangement referred to by the author of placing insurance on a picked number of a graduating class of a college rather than on all members of the class might involve a speculative element. This feature was farthest from the author's mind when the suggestion was made as it was assumed that the insurance would be taken out on a representative portion of the class. The author's main thought was to bring out the fact that the premiums should be paid by

the class secretary and should be raised among the members of the class as class dues—this in order to prevent the large lapsation of policies which would follow if each individual attempted to pay his premiums direct and without knowledge of other members of the class. Again, by issuing a smaller number of policies, considerable time and expense would be saved. In short, it was thought that the proposed plan would assume a more businesslike form than if comparatively small individual policies were issued. Of course, the main argument involved the better results which would be obtained if the responsibility for the results of the plan were controlled under a proper class officer.

In discussing the small employer group Mr. Woodward refers to the statutory limitation of the group definition of fifty lives. In this connection a further point should be inserted which Mr. King in his discussion mentions, *i.e.*, the limitation of the group definition does not depend entirely upon the mortality question involved but in addition upon the question of expense. Mr. King argues the point that there is little saving in the expense of handling either group or wholesale cases beyond the acquisition cost. If the group limitation were made twenty-five lives rather than fifty lives, the companies would perhaps have attempted to cover such small groups at the low group rates. It may be argued that there is a certain overhead expense incident to each group policy outside of the issuance of policies, certificates, etc. I am not prepared to say that such overhead costs a company twenty times as much in handling twenty group policies of fifty lives each as it does for one group policy involving one thousand lives, but it is fair to state that the company is compelled to meet an overhead cost in handling the fifty-life group of considerably more than one-twentieth of the cost of such overhead in handling the one-thousand life group. Or, to put the matter in another way, the company writing group insurance confined entirely to small groups would have an overhead which would be greater than that of the company which confined its business to large groups even where the total number of lives insured was the same, in which event the margin of profit due to expenses alone would be much smaller for the former company—a condition which naturally would affect the minimum group policy which the company could afford to write. As a matter of practice, the companies in order to avoid discrimination probably use the same scale of rates for all standard groups and consequently could afford to quote such rates only where the average group policy was of a satisfactory size.

Mr. Watson has confined his discusssion to a very different angle and points out certain difficulties which have arisen through the attempt of our legislators to define detail rather than principle.

As already stated, Mr. King has included an interesting argu-

ment involving the effect of expenses on the cost of group insurance.

The author holds no brief for the so-called "insurance-savings" plan beyond the belief that as a thrift proposition it possesses unusual merit. This plan would probably bring upon the company's books quite a different grade of risks than usually solicited, *i.e.*, the small but thrifty wage earners, many of whom would probably be of foreign birth or parentage. It is true that the plan in practice introduces a good many agency problems.

The monthly premium proposition which is involved, however, is important and should receive the consideration of all companies, whether interested in this particular plan or not.

The author does not view with such timidity the case cited by Mr. Little of the bank that fails, for the reason that ordinarily the bank would be tied up with the insurance company only as far as the collection of premiums on the insurance benefit is concerned. If the bank fails, the insurance company might, of course, be obligated to carry the insurance feature separately, and the savings feature would simply cease unless another bank assumed control. An insurance company in closing with a bank naturally would not close unless it were satisfied with the bank's standing. Furthermore, the bank is under a certain supervision by the state or federal banking authorities. The proposition, therefore, is very different from the one sometimes tried out but generally without success, in which an insurance company agrees to offer insurance in conjunction with the selling of bonds of the promoter type. Here the use of the insurance company's name in the transaction undoubtedly influences the purchase of bonds; in short, is a connection which in most instances should be avoided.

Mr. Little's comments on certain of the difficulties involved in the insuring of members of associations, even of the employer type, where premiums are contributed jointly by employer and employee, should be carefully noted.

Mr. Breiby gives an interesting personal experience involving the handling of a reinsurance of a large labor union and suggests some of the difficulties to which a company would expose itself if it attempted to handle such risks.

The point of view expressed in Mr. Evans's remarks is from quite a different angle, nevertheless of interest.

So I would suggest to those that read the paper that they also read as carefully the discussions which have ensued, for the reason that they will find these discussions particularly valuable.

A Study in Surplus Distribution using the American Men Table as a Guide.

BY

SHERMAN C. KATTELL.

As I have figured the net costs (premium less dividends) of different companies I have wondered what the exact relation should be between the interest returns of two companies earning about the same net rate, but one operating, we will say, on a 3 per cent. basis and the other on a 3½ per cent. basis. As a preliminary to this paper I am presenting the result of a brief study on this relation. I have considered that these companies are each able to distribute interest surplus on a 4½ per cent. basis. The first company bases its premiums and reserves on the American 3 per cent. table and the second company on the American 3½ per cent. table. We will assume that the mortality experiences of these companies are about the same, and inasmuch as I have chosen the same mortality table in each case, there would be practically no difference in mortality return. We may also consider return from loading as foreign to this study. We need then to consider only the difference in interest return. I have chosen a 20-Year Endowment policy issued at age 35 for this study. The obvious reason for choosing the 20-Year Endowment policy is that it comes to an end within a reasonable number of years. The net premium on the 3 per cent. basis is $41.97 per $1,000, and on the 3½ per cent. basis $40.12. The difference in net premiums amounts to $1.85, and the present value of this difference over the period of twenty years should equal the present value of the differences in interest return over the same period. $\$1.85 \times 12.542 = \$23.20$ where 12.542 is the temporary life annuity-due for 20 years at age 35, according to the American 4½ per cent. table.

In the above table is figured the present value of the difference in interest return, the discount factors being taken from the American 4½ per cent. table. The total of these present values amounts to $23.23 as against $23.20, the present value of the difference in premiums. This shows that in the long run, as regards

surplus interest only, one interest basis gives the same net cost as another. However from column (4) we see that the 3½ per cent. policy is cheaper during about the first nine years of insurance, at which point the 3 per cent. policy becomes cheaper and continues increasingly so during the remainder of the term.

20-Year Endowment, Age 35

(1)	(2)	(3)	(4)	(5)	(6)
Yr.	1½ percent Init. Res. Amer. 3 percent.	1 percent Init. Res. Amer. 3½ percent.	(2) − (3).	Discount Factors.	(4) × (5).
1	$ 0.63	$0.40	$0.23	.956938	$ 0.22
2	1.15	0.73	0.42	.907537	0.38
3	1.69	1.07	0.62	.860564	0.53
4	2.24	1.43	0.81	.815902	0.66
5	2.82	1.80	1.02	.773421	0.79
6	3.42	2.18	1.24	.733021	0.91
7	4.03	2.58	1.45	.694585	1.01
8	4.67	3.00	1.67	.658023	1.10
9	5.34	3.44	1.90	.623232	1.18
10	6.03	3.89	2.14	.590122	1.26
11	6.74	4.36	2.38	.558594	1.33
12	7.48	4.85	2.63	.528573	1.39
13	8.25	5.37	2.88	.499963	1.44
14	9.05	5.90	3.15	.472692	1.49
15	9.88	6.46	3.42	.446679	1.53
16	10.74	7.04	3.70	.421842	1.56
17	11.64	7.65	3.99	.398113	1.59
18	12.57	8.29	4.28	.375430	1.61
19	13.54	8.96	4.58	.353735	1.62
20	14.56	9.66	4.90	.332973	1.63
Total ..	.....	.....	.....	.....	$23.23

If a life policy or a limited number of years under an endowment policy had been chosen for this demonstration, it would have been necessary to discount the difference in reserves on the two bases at the end of the chosen period and add this value to the discounted difference in interest return in order to show a value equal to the discounted difference in net premiums over the period.

It is to be noted in computing the discount factors that the first one contains only the interest factor, the second one the interest factor for two years and mortality factor for one year and so on. This of course is due to the fact that our tables are made up on the assumption that claims are payable at the end of the year of death.

While most companies endeavor to distribute surplus from mortality according to their own experience, but few of them have sufficient business in force to form a smooth mortality table which

they would care to use as a guide in this distribution. It is therefore very useful to have a standard table compiled from a large amount of data which may be used in this connection. The American Men table seems to be especially well fitted for this purpose. It is the table most recently compiled, and undoubtedly represents more accurately than any other the average mortality among insured lives in this country. Mr. Hutcheson in his paper before the society in October, 1920, showed that the experience of his company had been practically a constant percentage of the American Men Select table at all ages. Mr. Evans and Mr. Gibb in their discussion of this paper with reference to their companies, more or less confirmed Mr. Hutcheson's theory that this table is a good measuring rod for expected death losses.

In this study I am assuming that the mortality of the company follows the American Men Select table and that the company is earning a net rate of at least $4\frac{1}{2}$ per cent. I am assuming also that the company's premiums and reserves are based on the American 3 per cent. table. The cost of insurance which the company would really expect to experience would be obtained by combining the American 3 per cent. reserves with the q_x from the American Men Select table. In order to simplify the calculation of these costs I have used the q_x factor from the AM$^{(5)}$ table instead of the Select. These costs serve just as well for this demonstration and later when they are used as a guide in distribution of mortality gains, a correction is introduced so that the Select table becomes the effective guide. The difference between the American 3 per cent. costs and the costs just mentioned would then be a proper distribution of mortality savings. Also there would be an interest surplus of $1\frac{1}{2}$ per cent. of the American 3 per cent. initial reserve. To show that his sort of a distribution is correct, I have selected a 20-Year Endowment policy at age 35 for demonstration. The American 3 per cent. net premium for this policy is \$41.966 and the AM$^{(5)}$ $4\frac{1}{2}$ per cent. net premium is \$34.378. Their difference is \$7.588, and this multiplied by the temporary life annuity-due for 20 years at age 35, of 12.913 according to the AM$^{(5)}$ $4\frac{1}{2}$ per cent. table gives \$97.99 as the present value of the difference in premiums over the 20-year period. If my surplus distribution is correct, the present values of these distributions should equal the present value of the difference in premiums. This calculation appears in the following table:

20-Year Endowment, Age 35

Yr.	(1) Amer. 3 per cent. Cost.	(2) Cost Amer. 3 per cent. Reserves, AM (5) q_x	(3) (1) − (2).	(4) 1½ per cent. Amer. 3 per cent. Init. Res.	(5) (3) + (4).	(6) Discount Factor.	(7) (6) × (5) = P.V. of Dividend.
1	$8.637	$4.615	$4.022	$0.629	$4.651	.956938	$ 4.45
2	8.449	4.592	3.857	1.148	5.005	.911350	4.56
3	8.241	4.570	3.671	1.686	5.357	.867800	4.65
4	8.036	4.544	3.492	2.242	5.734	.826183	4.74
5	7.806	4.527	3.279	2.818	6.097	.786401	4.80
6	7.571	4.515	3.056	3.415	6.471	.748355	4.84
7	7.310	4.499	2.811	4.033	6.844	.711944	4.87
8	7.034	4.487	2.547	4.674	7.221	.677089	4.89
9	6.732	4.443	2.289	5.339	7.628	.643698	4.91
10	6.416	4.397	2.019	6.027	8.046	.611702	4.92
11	6.063	4.313	1.750	6.741	8.491	.581020	4.93
12	5.688	4.191	1.497	7.482	8.979	.551583	4.95
13	5.264	4.027	1.237	8.251	9.488	.523335	4.97
14	4.797	3.792	1.005	9.049	10.054	.496203	4.99
15	4.272	3.488	.784	9.878	10.662	.470140	5.01
16	3.669	3.083	.586	10.739	11.325	.445079	5.04
17	2.965	2.558	.407	11.636	12.043	.420980	5.07
18	2.138	1.893	.245	12.570	12.815	.397801	5.10
19	1.161	1.051	.110	13.545	13.655	.375485	5.13
20	.....	.....	.....	14.563	14.563	.354007	5.16
Total							$97.98

The discount factors are from the AM(5) 4½ per cent. table and are computed in the same way as described in earlier part of paper.

The comparison was made at each of the quinquennial ages from 20 to 65 inclusive on the 20-Year Endowment policy, and in each case the present value of the difference in net premiums was found to equal the present value of the theoretical dividends. The comparison was also made in the same way using a five-year term policy, with the same results.

The cost factors on the basis of the American 3 per cent. reserves and AM(5) q_x were also computed for quinquennial ages at issue for Ordinary Life and 20-Payment Life. On each of the four plans mentioned these costs were subtracted from the corresponding costs of the American 3 per cent. table, and the percentage of these differences to the American 3 per cent. cost taken. The following table gives these percentages:

Percentages of Difference between American 3 Per Cent. Costs and Costs using AM(5) q_x with American 3 Per Cent. Reserves to American 3 Per Cent. Costs.

Whole Life.

Year of Ins.	Age at Issue.										Year of Ins.
	20	25	30	35	40	45	50	55	60	65	
1	49.8	46.6	47.1	46.6	40.4	28.9	16.0	5.9	0.1	−1.3	1
6	46.6	47.1	46.6	40.4	28.9	16.0	5.9	0.1	−1.3	0.8	6
11	47.1	46.6	40.4	28.9	16.0	5.9	0.1	−1.3	0.8	2.6	11
16	46.6	40.4	28.9	16.0	5.9	0.1	−1.3	0.8	2.6	6.0	16
21	40.4	28.9	16.0	5.9	0.1	−1.3	0.8	2.6	6.0	....	21

Twenty-Payment Life.

Year of Ins.	Age at Issue.										Year of Ins.
	20	25	30	35	40	45	50	55	60	65	
1	49.8	46.6	47.1	46.6	40.4	28.9	16.0	5.9	0.0	−1.3	1
6	46.6	47.0	46.6	40.4	28.8	15.9	5.9	0.0	−1.3	0.8	6
11	47.0	46.6	40.4	28.9	16.0	5.9	0.1	−1.3	0.8	2.6	11
16	46.6	40.4	28.8	15.9	5.9	0.0	−1.3	0.8	2.6	6.0	16

Twenty-Year Endowment.

Year of Ins.	Age at Issue.										Year of Ins.
	20	25	30	35	40	45	50	55	60	65	
1	49.8	46.6	47.1	46.6	40.4	28.9	16.0	5.9	0.1	−1.3	1
6	46.6	47.1	46.6	40.4	28.9	16.0	5.9	0.1	−1.3	0.8	6
11	47.1	46.6	40.3	28.9	16.0	5.9	0.0	−1.3	0.8	2.6	11
16	46.6	40.4	28.9	16.0	5.9	0.0	−1.3	0.8	2.6	6.0	16

From the above table it will be noted that regardless of the plan or year of insurance, these percentages are practically constant for attained age of the insured, decreasing gradually from about 50 per cent. at age 20 to zero at about age 60. These percentages of the American cost could then be used at attained age, and give an accurate distribution. The chief difficulty is that a varying percentage of the cost makes a cumbersome dividend formula, and impedes the rapid calculation of dividends. It is especially troublesome to make your estimate of the dividends payable in the next calendar year for the annual statement.

A number of companies are now distributing their surplus from mortality wholly or partly as a percentage of the amount at risk. This constant percentage of the amount at risk can be expressed as a varying percentage of the cost of insurance, as the following demonstration will show:

$$q_{x+n-1}(1 - {}_nV_x) = \text{Cost},$$

$$.001\ (1 - {}_nV_x) = \frac{.001\ \text{Cost}}{q_{x+n-1}},$$

$$= \frac{.001}{q_{x+n-1}} \text{ percent of the Cost.}$$

That is \$1.00 per thousand or 1/10 of 1 per cent. of the amount at risk at end of year equals a percentage of the cost of insurance for that year represented by $\frac{.001}{q_{x+n-1}}$.

In the following table we have a comparison at attained ages of the percentages of the American 3 per cent. cost, first according to the true standard (American 3 per cent. cost minus AM(5) q_x operating on American 3 per cent. reserves) and on the basis of \$5.00 per \$1,000 of the amount at risk less 15 per cent. of the cost.

Attained Age.	Method 1, % of Cost.	Method 2, % of Cost.	Attained Age.	Method 1, % of Cost.	Method 2, % of Cost.	Attained Age.	Method 1, % of Cost.	Method 2, % of Cost.
21	49.8	49.0	38	44.5	39.1	55	7.6	13.7
22	48.8	48.6	39	43.5	38.1	56	5.9	11.9
23	47.9	48.2	40	42.0	37.1	57	4.4	10.1
24	47.5	47.8	41	40.4	36.0	58	3.0	8.4
25	47.0	47.4	42	38.4	35.0	59	1.9	6.8
26	46.5	47.0	43	36.2	33.8	60	1.0	5.2
27	46.5	46.5	44	34.0	32.5	61	0.2	3.7
28	46.4	46.0	45	31.5	31.2	62	−0.5	2.3
29	46.6	45.5	46	28.9	29.8	63	−0.9	1.0
30	46.9	44.9	47	26.3	28.2	64	−1.3	− 0.3
31	47.0	44.3	48	23.5	26.7	65	−1.4	− 1.5
32	47.4	43.7	49	21.0	25.0	66	−1.3	− 2.5
33	47.6	43.1	50	18.3	23.1	67	−1.1	− 3.5
34	47.4	42.4	51	15.9	21.3	68	−0.8	− 4.5
35	47.0	41.6	52	13.7	19.4	69	−0.3	− 5.4
36	46.6	40.9	53	11.5	17.5	70	+0.2	− 6.2
37	45.6	40.0	54	9.5	15.6			

Making a study of this table we will see that the proposed method distributes less than the true standard from attained age 28 to 45, the greatest variation of 5.7 percent being at age 36. From attained age 46 to 64 the proposed method distributes more, the greatest variation of 6.1 percent coming at attained ages 54 and 55. Beyond attained age 70 it would be necessary to vary the negative percentage of the cost in order that the distribution might follow the true standard more closely.

It would seem likely that these positive and negative deviations would about counterbalance each other, the simplicity of the

method justifying the slight errors introduced. To satisfy myself that this would be true I took the costs on our business for the policy year from anniversaries in 1921 to anniversaries in 1922 on issues of the years 1902, 1903, 1910, 1911, 1918, and 1919 for Whole Life, 20-Payment Life and 20-Year Endowment. These costs were arranged by attained ages and multiplied in turn by the two sets of percentages. The difference in totals was found to be less than $\frac{1}{10}$ of 1 per cent. of the total costs involved.

In this distribution of surplus from mortality the American Men Ultimate table has been used. In order to make the effective return on the basis of the Select and Ultimate table, I should add to all dividends at each age at issue, the difference between the AM Select $4\frac{1}{2}$ per cent. net premium and the AM$^{(5)}$ $4\frac{1}{2}$ per cent. net premium for that particular age at issue.

We might well consider this study complete without any reference to distribution of surplus from loading. At the same time a brief mention of this factor would not be out of place. For this phase of the study I have used a gross premium formed by loading the American 3 per cent. net premium 10 per cent. of plan and 15 per cent. of net premium of Ordinary Life. For the commission portion of the expense I have used the scale provided in the New York statutes, namely nine renewals of $7\frac{1}{2}$ per cent., five more of 5 per cent. and 3 per cent. thereafter. For the first year commission I have used 45 per cent. In addition to this I have considered that the company would be subject to a general expense of $2.75 per $1,000 of insurance. For companies operating on a net premium reserve basis it seems wisest to me to put all expenses in one lump sum and distribute them over the entire business without any special attention to initial expense.

For a well-established company doing a normally increasing business I am assuming that 10 per cent. of the gross premiums for Life policies and 9 per cent. for Endowment policies would about cover the commissions as outlined above. On account of the smaller first year commissions generally paid on the shorter term endowments 9 per cent. would seem to be sufficient for this class. In my dividend formula I am therefore entering a factor which shall consist of loading less an expense charge of 10 per cent. of the gross premium plus $2.75 per $1,000 of insurance for Life policies and loading less an expense charge of 9 per cent. of the gross premium plus $2.75 per $1,000 of insurance for the 20-Year Endow-

ment plan. If it seemed advisable this percentage of the gross premium could be varied for the Short Payment Life policies and Endowments other than 20-year according to first year commissions paid.

The interest factor in this distribution is $1\frac{1}{2}$ per cent. of the initial reserve.

While I do not consider the actual results under this formula as of the greatest importance, nevertheless I am giving them as a percentage of the gross premium for the three principal plans at three ages at issue for the first five, the tenth, fifteenth and twentieth years of insurance.

End of Year.	Whole Life.			20-Payment Life.			20-Year Endowment.			End of Year.
	Age at Entry.			Age at Entry.			Age at Entry.			
	20	35	50	20	35	50	20	35	50	
	Prem. 18.01	Prem. 26.35	Prem. 45.45	Prem. 27.60	Prem. 36.00	Prem. 52.70	Prem. 47.01	Prem. 49.32	Prem. 58.52	
1	17.7	15.2	13.2	11.7	11.3	11.6	7.9	9.2	11.5	1
2	18.0	15.7	13.6	12.3	11.9	12.1	8.7	10.0	12.0	2
3	18.4	16.1	14.0	13.0	12.6	12.6	9.5	10.8	12.6	3
4	18.9	16.6	14.4	13.7	13.3	13.1	10.4	11.6	13.2	4
5	19.3	17.2	14.8	14.3	14.0	13.7	11.3	12.4	13.8	5
10	21.7	19.8	16.5	18.2	17.8	16.4	16.3	17.1	17.2	10
15	24.5	22.5	17.8	22.8	22.3	19.8	22.3	22.8	22.0	15
20	27.5	25.1	18.7	28.3	27.7	25.3	29.7	30.3	30.3	20

It would seem that a life insurance policy should pay its way very largely as it goes. This however is quite impossible under a net premium system of valuation with the present large initial expenses. It has therefore been especially interesting to me to investigate the problem of surplus distribution for a company valuing on the Illinois Standard basis. In doing this I have not thought particularly of those companies now using this method of valuation, but more of an established company now using the net premium system, which might put its new business on the Illinois Standard basis if allowed to do so by State law.

I have again found costs of insurance by using the American 3 per cent. Illinois Standard reserves and the q_x factors from the AM(5) table. As before these costs were subtracted from the American 3 per cent. Illinois Standard costs, and ratios taken of these differences to the American 3 per cent. Illinois Standard costs. This was done for the three principal plans, and these ratios were

found to be uniform for attained ages without any regard to the plan or year of insurance. Moreover these ratios were found to coincide almost exactly with the ratios found when using the American 3 per cent. net premium reserve. For the mortality element of the distribution I have therefore used exactly the same formula, namely $5.00 per thousand of the amount at risk minus 15 percent of the cost of insurance. Also in each of these dividends was included the difference between the AM(5) 4½ per cent. net premium and the AM Select 4½ per cent. net premium for that particular plan and age at issue in order that the mortality distribution might follow the AM Select table. For the interest element I have again used 1½ per cent. of the initial reserve.

Under the circumstances which I am assuming there would seem to be no need for larger expenses than under the net premium system. I am therefore assuming exactly the same gross premium and the same expenses. The difference lies in the fact that I have endeavored to segregate first year expenses from expenses on old business. In doing this I found that a first year commission of 45 percent and $5.25 per thousand of insurance, with a renewal expense of 6½ per cent. of the gross premium plus $2.25 per thousand of insurance would amount to about the same as the 10 per cent. and 9 per cent. of gross premium for life and endowment policies respectively plus the $2.75 per $1,000 of insurance.

In calculating the dividends for the individual plans I have used the first year commissions applying to that particular plan rather than the average of 45 per cent. The first year commissions used were 50 per cent. for Ordinary Life, 45 per cent. for 20-Payment Life, and 35 per cent. for 20-Year Endowment.

It is interesting to note that the loading for the first year on the Ordinary Life Plan up to about age 45 is not sufficient to provide for first year expenses, and leave enough to pay a first year dividend which would be at all in accord with the dividends as they work out for the second and succeeding years. Above age 45 the margin is a trifle more than sufficient for this purpose. When we consider the 20-Payment Life and 20-Year Endowment Plans we find that there is sufficient margin even at the youngest ages to pay an adequate dividend in the first year and at the older ages this margin becomes considerably more than sufficient.

In order that we might show a first year dividend in sequence with those following, I have taken the amount by which the first

dividend needed to be increased or decreased, divided it by eight and decreased or increased the succeeding dividends by that amount. I am showing in the following tables the percentage of these dividends to the gross premium before and after the smoothing operation:

Before Smoothing.

End of Year.	Whole Life.			20-Payment Life.			20-Year Endowment.			End of Year.
	Age at Entry.			Age at Entry.			Age at Entry.			
	20	35	50	20	35	50	20	35	50	
	Prem. 18.01	Prem. 26.35	Prem. 45.45	Prem. 27.60	Prem. 36.00	Prem. 52.70	Prem. 47.01	Prem. 49.32	Prem. 58.52	
1	1.3	12.2	17.7	24.3	28.2	27.8	9.3	20.7	31.1	1
2	22.2	18.0	14.1	13.7	12.4	11.7	9.4	9.8	10.5	2
3	22.6	18.6	14.5	14.4	13.1	12.2	10.3	10.6	11.2	3
4	23.0	19.1	14.9	15.1	13.8	12.8	11.1	11.4	11.8	4
5	23.4	19.5	15.3	15.8	14.5	13.3	12.0	12.2	12.5	5
10	25.9	22.2	17.0	19.8	18.5	16.2	17.1	17.0	15.9	10
15	28.6	25.0	18.4	24.6	23.1	19.8	23.3	22.9	20.8	15
20	31.7	27.7	19.3	30.3	28.7	25.7	30.8	30.6	29.4	20

After Smoothing.

End of Year.	Whole Life.			20-Payment Life.			20-Year Endowment.			End of Year.
	Age at Entry.			Age at Entry.			Age at Entry.			
	20	35	50	20	35	50	20	35	50	
	Prem. 18.01	Prem. 26.35	Prem. 45.45	Prem. 27.60	Prem. 36.00	Prem. 52.70	Prem. 47.01	Prem. 49.32	Prem. 58.52	
1	19.5	16.9	14.1	13.4	12.8	12.5	8.6	10.3	12.3	1
2	19.9	17.4	14.5	14.1	13.5	13.1	9.5	11.1	12.9	2
3	20.3	18.0	14.9	14.7	14.2	13.6	10.4	11.9	13.5	3
4	20.8	18.4	15.3	15.4	14.9	14.1	11.2	12.7	14.1	4
5	21.2	18.9	15.7	16.1	15.6	14.6	12.1	13.5	14.8	5
10	23.6	21.6	17.5	20.1	19.6	17.6	17.2	18.3	18.3	10
15	26.3	24.4	18.9	24.9	24.2	21.1	23.4	24.2	23.2	15
20	29.4	27.1	19.8	30.6	29.9	27.0	30.9	31.9	31.8	20

We might now ask how we should expect this last table of dividends to compare with the ones computed using the net premium method of valuation. We have assumed the same gross premiums and the same expenses in each case. Therefore at any time we should expect to have the same amount on hand or the same deficit under either method from any individual policy. The difference would be that under the Illinois Standard there would be a certain amount in the surplus funds which under the net premium method would be in the reserve. We should then expect

the Illinois Standard dividend to be larger than the net premium dividend by 3 per cent. of the difference in initial reserves for that year. Upon actual comparison we find that the Illinois Standard dividends at the younger ages at entry are more than 3 per cent. of the difference in initial reserve greater than the net premium dividends, while at the older ages the reverse is true. However the departure from this 3 per cent. is not very great and can undoubtedly be attributed to unequal expense distribution.

In a number of places throughout this paper I have been obliged to distribute varying percentages as a constant percentage over a period of years. In the first part I assumed 10 per cent. of the gross premiums for life policies and 9 per cent. for 20-Year Endowment policies as equivalent to the actual commissions paid. Again when dealing with the Illinois Standard I assumed $6\frac{1}{2}$ per cent. of renewal premiums as an average renewal commission. Also when smoothing out the Illinois Standard dividends I distributed the excess or deficit of the first dividend over the succeeding years. These assumptions were based on annuities calculated from commutation columns built up by using the AM Select table at $4\frac{1}{2}$ per cent., age at entry 35 combined with a withdrawal rate represented in the following table.

Year.	Withdrawal Rate.	Year.	Withdrawal Rate.	Year.	Withdrawal Rate.	Year.	Withdrawal Rate.
1	.125	6	.035	11	.02	16	.01
2	.060	7	.03	12	.02	17	.0075
3	.050	8	.025	13	.0175	18	.005
4	.040	9	.0225	14	.015	19	.0025
5	.0375	10	.0225	15	.0125	20	00 for this year and after.

In distributing surplus on paid-up policies I should use the same interest and mortality factors as on the premium-paying. To take care of the expense on this class of business I should introduce a negative factor of possibly $2.00 per $1,000 of insurance.

In this paper I have taken no account of surplus which might arise from incidental sources, such as surrenders, lapses, sale of securities, etc. I should be inclined to allow these to go toward the general increase in surplus.

In ending this paper I should like to explain that these dividend formulas are not put forward as practical ones for any individual company. Rather I should call attention to the method of attack as possibly helpful in solving the difficult problem of equitable distribution of surplus.

Discussion of Preceding Paper.

(WRITTEN DISCUSSION.)

MR. J. M. LAIRD:

One important feature of this paper is the proposed method of distributing surplus from mortality savings. The author assumes that the company values its business by the American Experience table with 3 per cent. interest but that its actual mortality does not exceed the American Men mortality. For simplicity in distributing dividends, he first assumes that the actual mortality agrees exactly with the American Men Ultimate mortality and later makes an adjustment to cover the savings during the select period of the American Men table.

The tabular cost of insurance by the American Experience table is

$$q_{x+n-1}\ (1-{}_nV_x).$$

The actual cost of insurance if the company carries American Experience reserves but incurs American Men Ultimate mortality is

$$q'_{x+n-1}\ (1-{}_nV_x),$$

where q'_{x+n-1} represents the rate of mortality by the American Men Ultimate table.

The mortality saving available for distribution as a dividend is therefore

$$(q_{x+n-1}-q'_{x+n-1})\ (1-{}_nV_x).$$

The ratio of this saving to the tabular cost by the American Experience table is

$$\frac{(q_{x+n-1}-q'_{x+n-1})\,(1-{}_nV_x)}{q_{x+n-1}\,(1-{}_nV_x)}$$

$$=\frac{q_{x+n-1}-q'_{x+n-1}}{q_{x+n-1}} \text{ or } 1-\frac{q'_{x+n-1}}{q_{x+n-1}}.$$

This simple formula shows that the ratio is determined by the attained age of the insured and is independent of the plan or year of insurance. It confirms the author's statement on page 422 based on his study of the actual figures given in his preceding table. The formula also explains why the same ratios are found when on page 425 the author uses the Illinois Standard reserves.

Mr. Kattell's true standard for distributing mortality savings is

$$(q_{x+n-1} - q'_{x+n-1})\ (1 - {}_nV_x).$$

In lieu of this he suggests using

$$.005\ (1 - {}_nV_x) - .15\ q_{x+n-1}\ (1 - {}_nV_x).$$

These are exactly equivalent if

$$q_{x+n-1} - q'_{x+n-1} = .005 - .15\ q_{x+n-1}.$$

That is, if

$$q'_{x+n-1} + .005 = 1.15\ q_{x+n-1},$$

or

$$\frac{q'_{x+n-1} + .005}{q_{x+n-1}} = 1.15.$$

By actual trial we find that the ratio is not exactly 1.15 at every age but that the figures are as follows:

Age 20	1.14
30	1.12
40	1.11
50	1.20
60	1.19
70	1.07
80	.97

The results will apparently be sufficiently close if the ratio is taken as 1.15 for all ages from 20 to 70 as Mr. Kattell suggests.

Mr. Kattell's formula for distributing mortality savings and excess interest earnings is:

$$.005\ (1 - {}_nV_x) - .15\ q_{x+n-1}\ (1 - {}_nV_x) + .015\ ({}_nI_x)$$
$$= .005\ (1 - {}_nV_x + {}_nI_x) + .01\ {}_nI_x - .15\ q_{x+n-1}\ (1 - {}_nV_x).$$

For practical purposes in applying this formula, the difference between the initial reserve and the final reserve is so small that it may be neglected. As the maximum difference between the initial reserve and the final reserve on a 3 per cent. basis is about $30.00 per thousand and as this difference is multiplied by .005, the maximum error thus introduced is $0.15 per thousand. If we assume that the initial reserve is equal to the final reserve, the formula reduces to:

$$.005 + .01\ {}_nI_x - .15\ q_{x+n-1}\ (1 - {}_nV_x).$$

MR. ARTHUR COBURN:

Mr. Kattell in his very able paper demonstrates that a company that uses a three-factor distribution cannot apply equitably a uni-

form percentage to the cost of insurance. One company that uses a percentage of the cost of insurance, varying however with the attained age of the insured, has not experienced difficulty in its usage.

Mr. Kattell shows that actual saving in mortality can be approximated by a constant on the amount at risk diminished by a percentage of the cost of insurance. I think this method does not afford flexibility sufficient to meet changing conditions.

I have found it difficult to derive satisfactory dividend factors by inductive analysis of the data of a company's business. Reasonable factors, however, can be obtained and then tested by the method outlined by Mr. Henderson which will be found on page 109 of Volume X of our *Transactions*. The trial and error method leads to a satisfactory system.

If surplus interest is allowed on the initial reserve, the early payment of claims requires a percentage addition to the actual claims incurred. The omission of any such adjustment causes a material error in the distribution at the older attained ages.

The *amount* of the surplus is affected by the method of valuation used. I think, however, it should be possible to devise a *system* of distribution that will apply equally well whatever method of valuation of the policy liabilities is used.

MR. PERCY C. H. PAPPS:

Mr. Kattell gives as a preliminary to the interesting paper on Surplus Distribution an analysis of surplus interest earnings. It may be demonstrated that the present value of the difference in net premiums according to two different rates of interest, computed at a still higher rate of interest, is equal to the present value at such higher rate of interest of the difference in surplus interest earnings on reserves at the lower interest rates plus the present value of the difference in reserves at the end of the period investigated. By taking a Twenty-Year Endowment policy as an example, Mr. Kattell drops out of consideration the difference in reserves, for his example is worked out for the full endowment period of twenty years.

The demonstration is not without interest and, so far as I am aware, it has not been printed.

Let P_x etc. relate to functions computed at interest i.

P'_x " " " " " " " $i+t$.
P''_x " " " " " " " $i+t+s$.

where t and s are positive.

Let it be assumed that for n years the present value of the difference in interest savings plus the present value of the difference in reserves at the end of n years is equal to

$$(P_x - P'_x)\mathbf{a}''_{x\overline{n}|}.$$

Then, the present value of the difference in interest savings alone for the first n years will be

$$(P_x - P'_x)\,\mathrm{a}''_{x\overline{n}|} - v''^{n}{}_{n}p_x\,({}_nV_x - {}_nV'_x)\,.$$

To include in the computations the $(n+1)$th year there must be added the present value of the difference in savings in interest in the $(n+1)$th year, which is

$$v''^{n+1}{}_{n}p_x\{(t+s)\,({}_nV_x + P_x) - s\,({}_nV'_x + P'_x)\}$$

and the present value of the difference in reserves at the end of the $(n+1)$th year, which is

$$v''^{n+1}{}_{n+1}p_x({}_{n+1}V_x - {}_{n+1}V'_x)\,.$$

Now,

$${}_{n+1}V_x = \frac{{}_nV_x + P_x}{vp_{x+n}} - k_{x+n}$$

and substituting, the present value of the difference in reserves reduces to

$$v''^{n+1}{}_{n}p_x\left(\frac{{}_nV_x + P_x}{v} - \frac{{}_nV'_xP'_x}{v'}\right).$$

Since $t+s+(1/v)$ and $s+(1/v')$ each equal $1/v''$, the sum of the present value of the difference in interest savings in the $(n+1)$th year and the difference in reserves at the end of that year is

$$v''^{n}{}_{n}p_x\,\{({}_nV_x + P_x) - ({}_nV'_x + P'_x)\}\cdot$$

If this be added to the expression assumed to be correct for the nth year, the total will be

$$(P_x - P'_x)\,\mathrm{a}''_{x\overline{n}|} + v''^{n}{}_{n}p_x\,(P_x - P'_x) = (P_x - P'_x)\,\mathrm{a}''_{x\overline{n+1}|}$$

or the present value of the difference in the first $(n+1)$ net premiums. It may easily be shown that the relation is true for the first year and consequently, it is true for the second and all following years. The difference of a few cents in Mr. Kattell's figures is evidently due to an insufficient number of decimal places in his computations.

Mr. Kattell again uses the twenty years of a Twenty-Year Endowment policy to demonstrate the correctness of his distribution formula covering mortality and interest savings. This can be proved more generally, as follows:

Let P_x, etc., relate to functions computed at rate i and with rate of mortality q_x

and P'_x, etc. relate to functions computed at rate $i+t$ and with rate of mortality q'_x.

It may be assumed that the present value of the savings in interest and mortality during the first n years plus the present value of the difference in reserves at the end of n years is equal to the present value of the difference in the first n premiums; where the present value is computed at the rate of $(i + t)$ and mortality corresponding to q'_x. The present value of the savings in interest and mortality alone will, therefore be

$$(P_x - P'_x)\, a'_{x\overline{n}|} - v'^{n}{}_{n}p'_x\, ({}_nV_x - {}_nV'_x).$$

To include the $(n + 1)$th year there must be added the present value of the interest and mortality savings of the $(n + 1)$th year which amounts to

$$v'^{n+1}{}_{n}p'_x\, \{t({}_nV_x + P_x)\} + v'^{n+1}{}_{n}p'_x\, (q_{x+n} - q'_{x+n})\, (1 - {}_{n+1}V_x)$$

and the present value of the difference in reserves at the end of the $(n + 1)$th year, which is

$$v'^{n+1}_{n+1}p'_x\, ({}_{n+1}V_x - {}_{n+1}V'_x).$$

The present value of the mortality savings and difference in reserves taken together are equal to

$$v'^{n+1}{}_{n}p'_x\, (p'_{x+n} - p_{x+n})\, (1 - {}_{n+1}V_x) + v'^{n+1}_{n+1}p'_x\, ({}_{n+1}V_x - {}_{n+1}V'_x)$$

and this reduces to

$$v'^{n+1}_{n+1}p'_x\, (1 - {}_{n+1}V'_x) - v'^{n+1}{}_{n}p'_x p_{x+n}\, (1 - {}_{n+1}V_x).$$

But

$${}_{n+1}V_x = ({}_nV_x + P_x)\, u_{x+n} - k_{x+n}\,.$$

$$\therefore\ 1 - {}_{n+1}V_x = \frac{1}{p_{x+n}} \left\{ 1 - ({}_nV_x + P_x)\, (1 + i) \right\}.$$

Substituting in the previous expression and reducing there remains

$$v'^{n+1}{}_{n}p'_x ({}_nV_x + P_x)\, (1 + i) - v'^{n}{}_{n}p'_x\, ({}_nV'_x + P'_x).$$

Adding to this the present value of the savings in interest gives

$$v'^{n}{}_{n}p'_x\, ({}_nV_x + P_x - {}_nV'_x - P'_x) \text{ for } 1 + i + t = 1/v'.$$

If this last expression is added to the present value of the interest and mortality savings of the first n years, the total reduces to

$$(P_x - P'_x)\, (a'_{x\overline{n}|} + v'^{n}{}_{n}p'_x) = (P_x - P'_x)\, a'_{x\overline{n+1}|}.$$

If the relation is true for the nth year it is true for the $(n + 1)$th year and since it can be demonstrated to be true for the first year it is true for the second and all following years.

The present value of the difference in net premiums is equal to the present value of the theoretical dividends not only at the ages tested by Mr. Kattell, but at all ages at entry and for all durations. The foregoing demonstration is perfectly general so the relation is true for all plans of insurance.

Since the cost of insurance is of the form $q_{x+n}\,(1 - {}_{n+1}V_x)$ the percentages shown for Whole Life, Twenty-Payment Life and Twenty-Year Endowment are of the form

$$\frac{(q_{x+n} - q'_{x+n})\,(1 - {}_{n+1}V_x)}{q_{x+n}(1 - {}_{n+1}V_x)}$$

which reduces to

$$1 - \frac{q'_{x+n}}{q_{x+n}}$$

and is independent of the plan of insurance, in fact, depends only upon the attained age. Mr. Kattell says the percentages are practically constant for attained age of the insured and they will be entirely so if a sufficient number of decimal places are used in the computations.

Mr. Kattell states that a varying percentage of the cost makes a cumbersome dividend formula and impedes the rapid calculation of dividends. By combining the savings in interest and mortality a useful formula for computing dividends may be obtained.

Let saving in interest be t and saving in mortality r times the tabular cost of insurance, where r may vary with age and duration, if desired.

Then, total saving from interest and mortality in the nth dividend is $({}_{n-1}V_x + P_x)t + rq_{x+n-1}(1 - {}_nV_x)$, and $t({}_{n-1}V_x + P_x) = vt\,(p_{x+n-1}\,{}_nV_x + q_{x+n-1})$. Adding the saving in mortality, the total is

$$\begin{aligned} &(vt\,p_{x+n-1} - rq_{x+n-1})\,{}_nV_x + (vt + r)q_{x+n-1} \\ &= \{vt - (vt + r)q_{x+n-1}\}\,{}_nV_x + (vt + r)q_{x+n-1} \\ &= \alpha_{x+n}\cdot{}_nV_x + \beta_{x+n}, \end{aligned}$$

where

$$\beta_{x+n} = (vt + r)\,q_{x+n-1}$$

and

$$\alpha_{x+n} = vt - \beta_{x+n}.$$

If the beta factor is first placed on the product pins of the multiplying machine, one multiplication of the reserve at the time the dividend is due by the alpha factor gives the total interest and mortality saving. The alpha and beta factors are listed at the age attained when the dividend is due. Since the loading factor of the dividend is quite frequently constant for at least a number of years, the dividends can be very rapidly computed by this formula. When the mortality saving, r, is constant for each

attained age, one set of alpha and beta factors is all that is required. If r varies according to duration to allow for selection, a different set of factors must be computed for each year of the period of selection.

Mr. Kattell makes certain assumptions as to the expense charges that should be made against different classes of policies and bases his percentages upon the assumed commissions. If the commissions have been scientifically adjusted as to plan and age, such commissions may properly be used as a basis for expense charges. It should not be forgotten that commissions are quite often merely a convenient method of remuneration for agents, who might under certain conditions be paid fixed salaries which would be independent of the plans of insurance for which they secured applications. Since the policyholder has no knowledge of the commissions paid on various plans, expenses should be apportioned in accordance with what, in our opinion, each policy should bear.

If P'_x be the gross premium for ordinary life and ${}_{20}P'_x$ that for twenty-payment life policies; and if the expenses on ordinary life be eP'_x the expenses chargeable to twenty-payment life policies might be

$$\frac{e}{2}\,({}_{20}P'_x + P'_x) \text{ or } e \cdot \frac{a \times {}_{20}P'_x + b \times P'_x}{a+b},$$

where in the latter form a and b may be arbitrarily chosen. Some such method would seem to properly vary the expense charges for different plans.

Mr. Kattell does not advocate his dividend formulae for the use of any particular company. When it comes to the practical distribution of surplus, it may be remembered that a considerable portion of mortality savings may properly be used as an offset to a corresponding amount of new business expenses. Such an offset will be found in a number of dividend scales. When it is realized that with the three-factor method of dividend distribution, quite different factors may produce quite similar dividends, and when it is found that the dividends produced by a two-factor method are not widely different from those produced by using three factors, the final results rather than the method employed are the all important consideration.

In conclusion, I wish to congratulate Mr. Kattell in bringing the question of surplus distribution before the Society. It is a subject that can be viewed from many angles and I hope that we may have other contributions along similar lines.

MR. VALENTINE HOWELL:

The preliminary portion of Mr. Kattell's paper consists of a demonstration of the correctness of the theory of surplus distribution by which the interest return is based on the initial reserve,

and the mortality profit is taken as the difference between the actual and the tabular rates of mortality multiplied into the tabular amount at risk. It is shown in a number of illustrations that the present value of the difference in premiums, one of which is based upon the American Experience at 3 per cent. and the other upon the rates of mortality and interest assumed to prevail, is equal to the present value of the sum of the dividend contributions from mortality and interest, calculated as indicated above.

This conclusion, I believe, might have been reached by reasoning somewhat along the following lines: If, from year to year, the excess interest earned over 3 per cent. based on the funds at interest according to the assumptions made in calculating the reserve, is returned to the policyholder, together with the yearly savings in mortality measured by the American Experience table, then the funds retained by the company would be exactly equal to those in hand on an American Experience 3 per cent. basis. The net premium required would thus be the Amer. Exp. 3 per cent. net. On the other hand, if no dividends were paid, an $AM^{(5)}$ $4\frac{1}{2}$ per cent. net would be sufficient. Consequently, the present value of the yearly difference in these two premiums must be equal to the present value of the dividend contributions from interest and mortality. In practice, the discontinuance rate must not be lost sight of, as, due to the decreasing amount of business in force, a level dividend of the difference in premiums is more costly than one that increases from year to year, and the same holds true as between comparative rates of increase in dividends.

The kernel of the paper lies in the relation:

$$q_x[\mathrm{AM}^{(5)}] = 1.15\, q_x[\text{Amer. Exp.}] - .005$$

or

$$q_x[\text{Amer. Exp.}] - q_x[\mathrm{AM}^{(5)}] = .005 - .15\, q_x[\text{Amer. Exp.}],$$

which is assumed with satisfactory results under age 70 to hold true for all ages. Mr. Kattell has consequently secured an expression by which the difference between the actual and the tabular rates of mortality may be expressed as a fixed constant less a constant percentage of the tabular rate. The mortality profit, based on the American Men experience, can thus be directly expressed as a function of the cost of insurance and of the amount at risk, as, for all ages and durations, mortality profit per unit becomes equal to:

$$.005\ \ (1 - {}_{n+1}V) - .15\ (\text{Cost}),$$

or, including the interest and loading profit:

$$\text{Dividend} = .005\ \ (1 - {}_{n+1}V)\ - .15\ \text{cost} + .015\ \ ({}_nV + P)\ + A,$$

where A is equal to the loading contribution per unit plus the allowance for selection mentioned in Mr. Kattell's paper.

We thus have a four-factor dividend formula, which may be reduced to a three factor form, since the above equation is equal to

$$A + .005 + .00985\, IR - .145\ \text{Cost},$$

which, since $(A + .005)$ is constant for all durations, is a three-factor formula where the cost factor is negative.

The fact brought out that, if the American Men table is a correct measure of the mortality experience of the companies, the mortality cost factor, if taken to be a constant percentage of the cost, should theoretically be negative, is a somewhat ironical comment on the scientific accuracy of our dividend distribution formulae, and it may be noted that the companies using a two-factor method seem to approach closer to the truth than the others, added to which they have the advantage of greater simplicity in the calculation of their dividends. The truth is, that what is wanted is a simple formula that will arrive at a dividend increasing from year to year within reasonable limits and which will be of such a nature that the total amount of dividends payable by the company is capable of being estimated in advance for the purpose of the annual statement. Given such a method, the equities as between the different ages and plans of insurance may best be determined by some variation of Mr. Weeks' Asset Share method, and adjusted by varying the loading return.

The concluding portion of the paper is devoted to the modification in the dividend formulae necessary for a company valuing upon the Illinois Standard Reserve basis. Comparing the dividends arrived at by Mr. Kattell on the Illinois Standard basis and those based on the level premium reserve, we find that the latter are exceeded by the former at all ages and durations. Mr. Kattell's results consequently bring us to the somewhat astonishing conclusion that by merely varying the reserve basis the company is enabled to furnish insurance at a lower net cost throughout the entire history of the policy.

As this conclusion appears untenable, we must question the validity of the results. While we should indeed expect the Illinois Standard dividend to be larger than the net premium dividend by 3 per cent. of the difference in initial reserve for that year, the fact seems to have been ignored that there should also be deducted from the loading factor the difference in true net premiums as between the preliminary term and the straight level premium plans of valuation.

(ORAL DISCUSSION.)

MR. H. W. BUTTOLPH:

In our company we have distributed surplus by a method which seems to be based upon the same general plan as that suggested by the author. I was going to explain the mechanical method used by us, but as it seems to be similar to that referred to by Mr. Papps, I will not take the time for it. I want particularly to add my word of endorsement to the conclusion of the author, that surplus which may arise from lapses and surrenders should

be ignored. It has always seemed to me rather inconsistent that, considering the efforts which we make to prevent lapses, we should regard lapses as a source of profit to be reckoned with in the distribution of surplus.

I have wondered if one statement made by Mr. Kattell is altogether correct. The method adopted for computing discount factors seems to me due to the fact that he evidently contemplates the payment of a dividend to the beneficiary for the year in which the policy matures by death. The fact that our tables are made up on the assumption that claims are payable at the end of the year of death, seems to me to have nothing to do with it.

Only one other point—as a firm believer in a modified system of valuation and correct terminology I want to take exception to the use of the expression repeated a number of times, "Net premium system of valuation," and the consequent intimation that the Illinois Standard is not a net premium system of valuation.

MR. HENRY MOIR:

I, too, want to call attention to the remark which Mr. Buttolph has just made in regard to the net premium system. We should carefully distinguish between a *uniform* net premium system, and other net premium systems. The most interesting point in this paper to me was the formula giving $5.00 per thousand on the amount at risk *minus* 15 per cent. of the cost as a means of distributing mortality profit. This formula runs closely in harmony with the difference between the older American Experience and the new American Men table. But in surplus distribution, what Mr. Papps said is much more important, namely, that you want a practical method which can be easily explained. Many forms of distribution entirely different in appearance may give similar practical results. In other words, the two-factor method consistently applied will often give similar results to the more elaborate three- or four-factor methods. It would be hard to explain to a court of law that mortality should be partly distributed as a negative factor and at some ages the formula brings out negative results owing to the weight of the second part of the mortality formula. While admiring the theory, I am afraid that as a practical proposition it would not be good.

MR. T. B. MACAULAY:

As Mr. Moir has just done, I wish to pay my tribute to the author of this paper for the large amount of work which he has put into the effort to obtain a scientific basis for distribution of profits. If, however, we can get approximately the same results from a simple method, such as a two-factor system, I personally prefer the latter. It seems to me that all these highly refined

methods have as their basis the assumption that a company will divide yearly all the profit it earns. I do not know what other companies do, but we feel that we can do substantial justice to our policyholders by a two-factor system, giving profits which will steadily increase as the policies grow older and which will be entirely satisfactory to our members. We have no desire to divide the whole amount earned. In fact we try as much as we reasonably can to build up a reserve fund of unallotted surplus, for we consider this essential, especially in countries or states which do not permit the amortization plan of valuing securities, and where we must face the risk of fluctuation in market values. A company's first duty to its policyholders is to be safe. If it has a good year, I do not think it should divide all the surplus earned. If it has a poor year it should not necessarily cut down its rate of distribution. The earnings will vary from year to year,—one year large, the next year small, and perhaps in the third year a war. If we admit the principle that we must not divide all the profits earned year by year, and must always keep in mind the necessity of making the company strong by setting aside as much as we can to an unallotted surplus fund, then it seems to me that extreme refinements in the method of distributing surplus are not necessary. We can by the two-factor method do substantial justice to our policyholders, keep them satisfied, and at the same time strengthen the company.

(AUTHOR'S REVIEW OF DISCUSSION.)

MR. SHERMAN C. KATTELL:

The discussion of this paper has been of such a nature that very little need be said in reply. However there are a few points which would seem to bear further comment.

Mr. Howell in his discussion has given a written statement of my dividend formula as follows:

Dividend at end of $(n+1)$th year =

$$.005\ (1 - {}_{n+1}V) - .15\ \text{Cost} + .015\ ({}_{n}V + P) + A$$

where A is the contribution from excess loading. This statement is correct as a whole and also in its various elements. It should be borne in mind that the mortality element is a varying percentage of the cost, conveniently expressed in this formula by the quantity $.005\ (1 - {}_{n+1}V_x) - .15$ Cost.

Mr. Howell has reduced this formula to

$$A + .005 + .00985\ ({}_{n}V + P) - .145\ \text{Cost}.$$

This is correct as a whole and possibly simpler for calculation purposes. He has then pointed out that the mortality element in this reduced formula is negative in contradistinction to the general

usage. I want to point out that not only is the mortality element distorted but so are the other elements. In place of the $1\frac{1}{2}$ per cent. of the Initial Reserve, we have 985/1000 of 1 per cent., and in place of a loading return of A, we have \$5.00 per \$1,000 of insurance plus A. In other words this reduction of the formula has so distorted the individual elements that in my opinion it should have no place in an analysis of the formula.

I am inclined to agree with Mr. Howell that my dividends under the Illinois Standard valuation are somewhat too large. The loading factor was correctly calculated, but it is evident that the expense charges assumed in this case do not harmonize with those assumed in case of the net level premium dividends. In the latter part of my paper I assumed that two companies using the same gross premium and having the same expenses would have the same amount on hand under each policy, the difference being that an Illinois Standard company would have less in the reserve fund and more in the surplus fund. As a consequence of this assumption I stated that the Illinois Standard company could pay a dividend larger than the net premium company by 3 per cent. of the difference in initial reserves. This would be true as long as the total funds remained equal, but it becomes quite evident that the Illinois Standard company, by paying larger dividends, would destroy the equality of the total funds and thus lose its advantage. However it would seem that a company could pay larger dividends on an ordinary life policy throughout its existence if valuing on the Illinois Standard basis, inasmuch as the reserve on this basis becomes equal to the net level premium reserve only on reaching the end of the mortality table.

In spite of Mr. Buttolph's protest, I believe the reason I gave for calculating my discount factors as I did, to be the correct one. When the year is once entered upon, it will be finished according to our theory, as claims are not payable until the end of the year. That is according to the theory the same dividend could be paid at the end of the year whether the insured lived or not. Consequently in computing the present value of future dividends we must always discount one year less for mortality than for interest.

I want especially to thank the gentlemen who have given general proofs for the special cases which I have considered. These are a great addition to the paper. Mr. Papps in particular has gone into much detail, as you might say, to complete the paper. He has called attention to the concluding paragraph of the paper in which I stated that my formulas were not put forward as practical ones for any individual company. With the interest, mortality and loading factors which apply to any particular company I believe that the formulas are practical. I meant that the results obtained by me should not be considered final.

Throughout the discussion results have been stressed as the im-

portant consideration rather than the method. I agree that the results are all important, but I fail to see how you can be sure that you get the correct results unless you use a scientific method. I am inclined to believe that many of the unscientific simple formulas which give the desired and correct results in some places fail to give equitable results in other places. If a scientific formula can be reduced to a simple form, as Mr. Linton has just stated is the case with his company, that is a result much to be desired.

Treatment of Claims for Permanent Total Disability.

BY

ARTHUR HUNTER.

The purpose of this paper is to discuss the difficult questions arising in connection with disability claims under the permanent total disability features of life insurance policies.

The question is frequently asked: Why do the life insurance companies not combine their experience so as to get a satisfactory basis for their guidance? The answer is, that sufficient time has not elapsed to give reliable experience, and that the conditions have varied greatly during the last ten years with regard to the form of disability benefit. It is not to be expected that the experience under the original "Waiver of Premium" benefit will be duplicated under the present "Monthly Income" benefits. Furthermore, the time at which like benefits begin varies in many companies, which would result in different rates of disability, of recorded deaths among disabled lives, and of recorded recoveries.

Types of Disability Benefits.

It would be difficult, if not impossible, to deal separately with the various types of disability benefits, but the principal problems are common to all of them. In considering the subject, the main phases of the development in disability benefits should be kept in mind. These are as follows:

1. *Protection of the Insurance.*

As disability would result in the insured perhaps being without funds to keep his insurance in force, the first policies covered this situation by providing for waiver of the premium in event of total and permanent disability.

2. *Protection of the Insurance and Payments to Insured.*

Protection of the insurance was not thought to be all that was needed, and accordingly provision was made for the maturity of the

policies in a certain manner on total permanent disability in order that the insured himself would receive in his lifetime material benefit from his insurance. These policies provide generally for the payment of 10 percent of the face of the policy annually, such payments being deducted from the face at death or at the end of endowment period. The premium is also waived.

3. *Protection of the Insurance; Payments to the Insured; Insurance kept Intact.*

In phase No. 2 the insurance was gradually reduced by the disability payments, with the result that the amount of insurance might be fully paid before the insured's death. The policies now accordingly provide for payment of an income of 10 percent of the face of the policy annually, or 1 percent monthly, no deduction being made from the face of the policy at death or at maturity. The premium is waived and in many companies the same annual dividends are paid as would be due if premiums were paid in full.

So far as the time of the first income payment is concerned, it should be remembered that this was originally made a year usually after proof of disability, whereas some of the more recent forms of contracts provide for payment of the first monthly income on receipt of proof of disability, or on the first day of the month following receipt of such proof.

Causes of Disability.

The most difficult question which the companies have to answer is: What constitutes permanent total disability? Two of the largest companies now provide that continuous total disability which lasts longer than three months shall be presumed to be permanent. It should be distinctly understood that we will not deal with this form of policy, which solves many of the difficulties in the treatment of claims, but will confine our consideration to the older forms.

If the companies insisted that the disability benefits would not be granted until there was proof that the disability was undoubtedly total and would undoubtedly be permanent, the claims approved would be much fewer than at present. The majority of the companies, however, are acting on the assumption that the insured shall under certain conditions be presumed to be per-

manently disabled and are treating the claims in a very liberal spirit.

A good way to determine the practice of the companies with regard to the treatment of claims is to study the causes of disability under "approved" claims. In order to gain additional light we will also study the claims which were disallowed, and those which were not carried to completion.

A table has been prepared showing the causes of disability under policies issued in the New York Life from 1910 to 1920, omitting claims under the present form of policy which provides that continuous total disability of more than three months' duration entitles the insured to the disability benefits. In the following table appear the causes of disability in all cases where the diseases resulted in one-half of one percent or more of the total approved claims:

Cause of Disability	Number of Cases.	Percentage to Total Claims.
Tuberculosis of the lungs	694	41.6%
Other forms of tuberculosis	36	2.1
Insanity, including 85 cases of dementia præcox	246	14.7
Accident	106	6.3
Paresis	88	5.3
Paralysis of all forms, including infantile.	77	4.6
Cancer and tumors	58	3.5
Heart disease	51	3.1
Neurasthenia	28	1.7
Blindness and diseases of eye	20	1.2
Arthritis	20	1.2
Locomotor ataxia	17	1.0
Diabetes	17	1.0
Apoplexy	17	1.0
Rheumatism (articular)	16	1.0
Bright's disease	15	.9
Neuritis and sciatica	13	.8
Anæmia, pernicious	12	.7
Epilepsy	9	.5
Goitre, exophthalmic	8	.5
Other diseases	122	7.3
Total	1,670	100.0%

It appears from this table that three-quarters of the claims arise from tuberculosis, insanity, paresis, paralysis and accident.

Now, let us consider claims which were not allowed. One hundred of such cases have been tabulated, with the following results:

Disallowed Claims.

Causes of Disability.	Percentage to Total Disallowed Claims.
Illnesses of a presumably *temporary* nature, the principal of which were neurasthenia, sciatica, rheumatism, neuritis, appendicitis, indigestion, anæmia, insomnia and jaundice	35%
Illnesses which did not then, but might at a later date cause total permanent disability, the principal of which were Bright's disease, heart disease, diabetes and empyema	28
Accidents causing injuries which partially or temporarily disable	23
Tuberculosis,—the insured had recovered from that disease or he had not submitted satisfactory proof of having tuberculosis	14
Total	100%

There is a group of cases where the information originally given to the company led us to assume that the claim might be a legitimate one, and accordingly forms for submitting proof were issued. The insured afterwards either withdrew the claim or did not answer our letters urging him to complete the proof. The following is a synopsis of one hundred of these claims:

Claims "Dropped" Voluntarily by the Insured.

Alleged Cause of Disability.	Percentage to Total "Dropped" Claims.
Illnesses of a presumably temporary nature, such as neurasthenia, appendicitis, rheumatism, sciatica, anæmia, malaria, pneumonia	46%
Tuberculosis	28
Illnesses which might lead to permanent total disability, such as heart disease, Bright's disease, diabetes	22
Accidents causing disability of a partial or temporary nature	4
Total	100%

There is naturally a difference between the proportion of causes of disability in the two preceding tables, due to the difference of conditions under which the claim was made. In the case of the disallowed claims the insured felt more sure of his ground in completing his claim than in the case of the claims which were voluntarily dropped by the insured. It is not necessary to com-

ment on these tables as their sole function is to show the type of claims which are not generally considered valid.

There is another group of cases where the letters received by the company clearly indicate that the illness or injury had not caused total permanent disability. It may be of interest to state that in 43 percent of these cases the cause was accident, involving fractures, dislocations and minor injuries; and in 10 percent the cause was the loss of one eye, foot, arm or leg. In the remainder the causes were obviously such as to result in temporary or partial disability. This type of claim indicates that some of the insured did not understand the terms of their contract.

Let us now consider the treatment of the principal causes of disability:

Tuberculosis.

The proportion of claims from tuberculosis to the entire claims varies in the published experience of several companies from 30 percent to 45 percent. I may state that our practice is to assume that the insured is totally and presumably permanently disabled when he gives up his occupation and (*a*) enters a sanitarium, or (*b*) goes, solely for health, to a locality which is considered favorable for the cure of the disease. We also pass favorably upon cases where the physicians think the insured can be cured at home, or where the conditions of the claimant make it practically impossible for him to leave his home—the insured in both cases having been forced by illness to cease work. In brief, then, our practice is to grant the disability benefits when it is proved that the insured has tuberculosis, that he has had to give up work, that he is unable to pursue any gainful occupation, and that he is under treatment. (Later I shall refer to dating back claims.)

The sooner the policyholder commences to take a "cure" the greater is his chance for recovery. If the payments of disability benefits assist him in arranging his finances so that he can take a cure earlier than he otherwise could do, it is to the mutual interest of the insured and the body of policyholders. There is a strong appeal from the humane side also for this attitude on the part of the company.

Reference has been made in papers to the percentage of recoveries from tuberculosis, but the data heretofore have not been sufficiently extensive to warrant the preparation of any table show-

ing the percentage of recoveries by *time elapsed* since the claims were approved. A statement of the proportion of recoveries to the total number of claims is of questionable value because a goodly proportion of the cases may have only recently incurred tuberculosis. An endeavor has therefore been made to show the percentages of recovery in each year of disability by taking into account not only the deaths and recoveries but those who were totally disabled at the end of each disability year. In the following table the percentages of deaths and recoveries to the total number of disabled at the beginning of each year are given:

TUBERCULOSIS OF THE LUNGS.

Year of Disability.	Percentage of Death.	Percentage of Recovery.
1st	27%	13%
2d	21	12
3d	15	11

Unfortunately, the cases are not sufficiently numerous to justify reliance on the percentages after the third year of disability,—hence the tables showing the rate of death and of recovery have been limited to the three years following approval of the claim.

The subdivision of the foregoing into two groups, (*a*) disabled before age 30 and (*b*) disabled after age 30, does not show any material difference in the percentage of death or of recovery. The percentages are slightly lower for the older group than for the former, which may be due to accidental fluctuation. The number of disability claims from applicants with tuberculosis is greater under age 30 than among those of an older age, as the following synopsis shows:

DISTRIBUTION OF CLAIMS BY AGE.

Under age 30	51%
30–39	33
40 and over	16

Insanity and Paresis.

There are various kinds and degrees of insanity, and some apparently hopeless cases have been cured. If the insured has been committed to an asylum the commitment papers should be sufficient evidence of disability; but there are other cases which should

be favorably acted upon. Occasionally a case arises where the insured lives at home and requires little in the way of attendance. In the case of dementia præcox, for example, it may not be necessary to confine the patient for some time after the disease has developed. It is usually comparatively easy in such cases to obtain proof that the insured is incapable of carrying on his work, from the attending physician, the medical examiner and the inspector.

In the case of true general paresis there is no chance of recovery. Accordingly where there is a well-marked case of paresis the claim should be promptly granted.

With regard to both insanity and paresis our practice is to date back the disability claims to the time of commitment to an asylum, or to the date when the insured became incapable of working. This practice is also carried out in connection with claims on account of death while insane, or death from paresis. Such claims are reviewed to determine whether or not the insured, if claim had been made on his behalf while still living, would have been entitled to the disability benefits.

Brief tables have been prepared to show the percentages of death and of recovery to the total number of disabled at the beginning of each year in the case of (*a*) dementia præcox, (*b*) other forms of insanity. In the case of paresis, which is not included in the foregoing, the percentage of deaths only has been given. While there were said to be five cases of recovery from paresis, the original diagnosis was probably incorrect.

DEMENTIA PRÆCOX.

Year of Disability.	Percentage of Death.	Percentage of Recovery.
1st	3%	7%
2d	4	6
3d	3	—

OTHER FORMS OF INSANITY.

Year of Disability.	Percentage of Death.	Percentage of Recovery.
1st	12%	23%
2d	11	12
3d	7	12

PARESIS.

Year of Disability.	Percentage of Death.
1st	38%
2d	41
3d	44

The amount of material is not large, as may be seen by referring to the table on page 434. While therefore dependence should not be placed on the individual percentages, general conclusions based thereon may be accepted with reasonable confidence. The death rate from paresis is very high, while that from dementia præcox is comparatively low. Among "Other Forms of Insanity" there was a wide range of cases—from persons hopelessly insane to those with a considerable prospect of recovery.

Paralysis.

In the cases of insured who have paralysis it is sometimes difficult to adjudicate a claim where the insured has paralysis of the legs. Fortunately, the cases are few. Paralysis of the legs may or may not incapacitate a person from carrying on a gainful occupation. In fact, there are instances of the afflicted person making as good a living in his profession or business as formerly. If therefore it were simply a question of whether or not he was able to carry on his occupation with reasonable efficiency there would not be a great deal of difficulty, but the policy provides that in the event of the loss of both feet (frequently a less serious impairment) the insured shall be deemed totally and permanently disabled. It seems a hardship to refuse to consider as disabled a man who is paralyzed and needs an attendant although he can attend partially to business, while the benefits are granted to a man who has lost both his feet and is capable of getting around without help by means of crutches or a cane. There is a strong tendency to treat with liberality the man with paralyzed legs who may be able, though with the help of others, to attend *partially* to his business affairs.

Cancer, Heart Disease, Diabetes, Bright's Disease, Apoplexy.

Among the other causes of disability are several, such as cancer, heart disease, diabetes, Bright's disease, and apoplexy, where the illness is almost certain to prove fatal, and where the insured usually does not give up his occupation until nearly the end. We have found little difficulty in the practical treatment of these cases, because the evidence submitted is usually conclusive as to the total and permanent character of the illness.

Rheumatism, Arthritis, Neuritis, Sciatica.

There is another group of diseases, constituting 3 per cent. of the approved claims, which do not usually cause total permanent disability, and are therefore difficult to handle,—namely, rheumatism, arthritis, neuritis and sciatica. The tables given in the early part of this paper show that claims on account of these diseases are sometimes allowed and sometimes disallowed by the company. In the case of the approved claims the attack must have been sufficiently severe to have kept the insured from work for a long period, and the evidence must show that there is no improvement in his condition. In general, it may be stated that the cases approved by us have had the disease in a severe form for at least six months.

In addition to the consideration of individual claims there are several practical questions of a general nature which arise, such as the following:

1. Should the benefits be dated back to the time the insured became totally and presumably permanently disabled?
2. Should a policy which has been lapsed during the total permanent disability of the insured be reinstated without reference to the insured's condition of health, and the disability benefits be allowed?
3. Should the policy be restored after the insured's death if it were lapsed during the total permanent disability of the insured when he had no knowledge of the benefit of his policy, or was not in a condition to apply for his rights?
4. Should claims for disability benefits be granted after the insured's death, the policy being in full force?

Let us take up each of these questions.

Should the Benefits be Dated Back?

For some time after disability benefits were added to life insurance policies the practice was to allow them to accrue only after proof had been submitted. Then followed a period in which the benefits were dated back in case of insanity, and in other cases where a too technical adherence to the letter of the policy caused injustice. Now-a-days a few companies date back the benefits to the time total permanent disability began. Our present practice is

to grant the disability benefits from the date of total permanent disability provided such date can be definitely determined and provided the disability of the insured at that date is established. When the date of total permanent disability cannot be definitely ascertained, the committee in charge of disability claims determines the date from which the benefits shall accrue.

Policy Lapsed while the Insured was Disabled.

It sometimes happens that the insured has lapsed his policy during total permanent disability. The most frequent case of this kind in our experience is where the insured is in a sanitarium for tuberculosis, and did not receive the notice of premium or was too sick to pay attention to it. In several cases we have not learned of the facts until the policyholder applied for reinstatement of his policy and was asked to furnish the usual evidence of insurability. Our practice is to reinstate the policy within a reasonable time without reference to the insured's condition of health and to grant disability benefits provided satisfactory proof is furnished that total permanent disability occurred before the policy lapsed.

In rare instances the matter of restoring a lapsed policy is not brought to our attention until after the death of the policyholder. If conclusive proof is submitted within a reasonable time of total permanent disability existing before the policy was allowed to lapse, our practice is to restore the policy to force: in other words, the case must be such that if the facts now known had been submitted to the company before the policy lapsed the benefit would have been granted.

Claims for Disability Benefits after Death of Insured.

Several types of claims for disability benefits arise after the death of the insured. The simplest of these is the case of the mental incapacitation of the insured before his death. I believe the practice of life insurance companies is to make the disability benefits effective, when the insured would undoubtedly have been granted these benefits on application during his lifetime. It seems to be the custom not to wait for a claim by the beneficiary in such cases but to review the death claim papers wherever the insured was mentally incapacitated before death, in order to determine whether the benefit should have been allowed.

There are other types, however, in which the matter is not so clear. Claim may be made by the beneficiary for a refund of the premium paid during the insured's last illness on the ground that he was then totally disabled. The disability benefits should be allowed, in my judgment, if there is satisfactory proof that the insured suffered from a disease which would normally result in permanent total disability, and did not suffer from an acute temporary disease. The approval of a claim for refund of the premium therefore would depend on whether the claim would have been allowed if made at the time disability was total and presumably permanent. All claims would be excluded in which the benefits would not have been granted if the insured had applied for them during his lifetime.

Conclusion.

When disability benefits were first granted the companies had little experience, and therefore proceeded with caution. As the great value of these benefits to the community was demonstrated, the companies have become increasingly liberal in their treatment of claims. While the policies generally provide that the disability benefits commence only after proof of such disability is received, the practice is developing to make the benefits accrue from the time the insured became totally and presumably permanently disabled. This practice assumes that the insured did not understand his rights; or that he was too sick to pay attention to his policy; or that the beneficiary did not know the provision of the insurance policy; or that the insured was mentally incapable of looking after his affairs.

The introduction of disability benefits into life insurance policies has done more to popularize these policies than probably any other feature. The public has recognized their peculiar value during a crisis in men's affairs. It is accordingly an obligation on all the companies to interpret the policies in a very liberal spirit so that the new feature may continue in popularity and develop in usefulness.

Discussion of Preceding Paper.

(WRITTEN DISCUSSION.)

MR. R. D. MURPHY:

Mr. Hunter presents figures which should be kept in mind by those who deal with the selection of risks. The underwriting of permanent total disability risks should be based on somewhat different considerations from those which underlie the acceptance of life insurance risks. An impairment that affects mortality by only a slight percentage may affect the disability experience seriously, and vice versa. The author shows that 43.7 per cent. of the claims in his company arose from tuberculosis. The Equitable's experience gives 40.3 per cent. from the same cause. It would, therefore, appear that the companies should refuse this disability coverage where the applicant shows any marked tendency toward tuberculosis on account of family or personal history or personal condition. We cannot, however, arrive at a true measure of the importance of the different causes of disability unless we take into consideration the duration as well as the frequency of claims from the several causes. It will be noticed from Mr. Hunter's figures that there is a high rate of death and of recovery in the cases of tuberculosis, while for insanity there is a considerably lower death rate. The Equitable's experience tends to confirm Mr. Hunter's results in a general way. While, therefore, only 14.7 per cent. of the claims in the New York Life Insurance Company arose from insanity as compared with 43.7 per cent. from tuberculosis, we cannot be confident that insanity is a much less important factor than tuberculosis in causing disability losses. In our experience 21.1 per cent. of the claims arose from insanity as compared with 40.3 per cent. from tuberculosis, thus emphasizing this point. It should also be kept in mind that Mr. Hunter's figures are based upon a relatively short experience and that at the later durations insanity may prove to be a much more frequent cause for disability claims than during the first few years of insurance. In any event it is clear that insanity as well as tuberculosis must be especially guarded against in accepting risks for the disability benefits.

Mr. Hunter's paper may bring up a question in the minds of some of us as to the meaning of permanent total disability in view of the established fact that benefits have been paid in cases that proved to be temporary total disability. If, again, claims are to be paid after the death of the insured following a long illness although disability had not been previously claimed, where are we to draw the line between different types of disability? It does

not seem to me that Mr. Hunter fully answers this question when he states: "The disability benefits should be allowed in my judgment, if there is satisfactory proof that the insured suffered from a disease which would normally result in permanent total disability and did not suffer from an acute temporary disease." It might be asked, for example, whether a disease is a temporary one if it results in the insured's death. Any serious confusion in this respect can be avoided if we decide that a total disability of a given type will be presumed to be permanent when, in the great majority of cases of that type, the total disability continues until death. Then such acute diseases as ordinarily result in recovery will be treated as temporary disabilities even though some individuals are continuously disabled until death. The only remaining problem is to decide how low the recovery rate should be to warrant the presumption of permanent total disability. Probably no company has as yet attempted to draw such a line with any precision. There has been a general disposition to treat disability claims leniently and it is undoubtedly true that more benefits have been granted than the companies would have been compelled to grant under a strict interpretation of their contracts. I think it is well, however, to emphasize the necessity for basing our action on classes of claims and not on individual cases.

The liberal practices outlined by Mr. Hunter with regard to handling claims can well be supported not only on the grounds of popularizing these benefits but also because of the position of trusteeship which the companies are more and more adopting toward their policyholders. Many people are not familiar with their rights under the disability clause, and if an insured becomes totally disabled he will be incompetent, in many cases, to make a claim. This is particularly true when the insured becomes insane. So far as is practicable without opening the door to fraud, the companies should act for the insured. There will be difficulty in getting adequate proof as to the commencement and nature of some disabilities in the past, but when we are dealing with insanity the date of commitment to an institution furnishes a sufficiently reliable basis.

Several companies have recently introduced policy forms containing the provision that total disability shall be presumed to be permanent when it has existed continuously for three months. The handling of claims will be consequently relieved of some of the perplexing questions that have arisen in the past. In the claim experience, however, we shall probably find that certain diseases are frequent causes for disability benefits though they do not appear or are of only infrequent occurrence in Mr. Hunter's list. Underwriters should be watchful in regard to this possibility, particularly in issuing substandard business, and I hope that Mr. Hunter and others will present their experience at a later date under such policy forms.

MR. J. D. CRAIG:

Mr. Hunter's paper refers exclusively to the different questions arising in connection with disability claims, rather than with the premium rates, reserves or general experience.

The questions presenting themselves in the settlement of disability claims are probably somewhat similar in all companies, and the methods and practices adopted by Mr. Hunter's company are naturally of interest to all.

In his conclusion Mr. Hunter states that when the disability benefits were first granted the companies had little experience and, therefore, proceeded with caution, while in the first part of the paper the different types of disability benefits are generally outlined. As experience developed the disability benefit has been enlarged, so that Mr. Hunter says two of the larger companies have made annuity payments begin at total and permanent disability or after three months of total disability. While this new form may solve many of the present difficulties experienced in the treatment of claims, it might also create new ones. The disability claims discussed in the paper are under policies presumably where the premium is waived at the next anniversary of the policy following receipt of proof of disability, and the annuity one year later.

Have not most of these difficulties arisen through the life insurance companies inadvertently entering the accident and health business? A distinctive benefit, through liberality of interpretation, has been extended until now the coverage is so similar that the line of demarcation at first created by permanent disability has been eliminated and benefits provided for temporary disability. In practice the term "permanent total disability" does not mean permanent total disability. The majority of the companies act on the assumption that the insured shall under certain conditions be assumed to be totally and permanently disabled, but the conditions on which that presumption will hold vary in different cases and with different companies.

Accident and health companies have been criticised and condemned for printing anything in their policies which is not considered to mean what it says and it is possible that similar criticism and condemnation will develop for life insurance companies if the practice is continued of interpreting the total disability clause by presumption. True, the tendency of the life companies has been to presume on the side of liberality, but Mr. Hunter has not given the number of claims disallowed and it is plain that a number of claims are being made under this clause by policyholders who, as Mr. Hunter says, do not understand their policies and consequently make claim for temporary disability just as they would under ordinary accident or health policies. Is it not this lack of workable definition of permanent and total disability in

the policy that makes the difficulty? While the motives of the management of the life insurance companies are beyond reproach, is it not this tendency toward continually increased liberality exercised through arbitrary presumptions rather than through policy conditions, that causes the difficulty?

The general practice of the company with which I am connected does not appear to be as liberal as that outlined by Mr. Hunter. The payment of disability benefits is looked upon more in a prospective than in a retrospective manner. Disability is recognized from the receipt of proof by the company or its representatives, but it is not made retroactive. To a certain extent conditions in the two companies are different, as in our company the waiver of premium benefit was granted on all outstanding policies from a certain date, but even on current policies the contract provides that disability will be recognized from the receipt of due proof, and this construction of the contract has been generally adhered to.

The causes of disability as experienced on practically the same number of cases shows a smaller percentage of tuberculosis and a larger percentage of insanity. The two combined represented 54 per cent. of the total in our company as compared with 50 per cent. given by Mr. Hunter. Paralysis constituted 12 per cent. of the claims in our company, as against 4.6 per cent. by Mr. Hunter. While tuberculosis gives the largest percentage of claims, our experience seems to indicate that insanity may be more expensive, as the tuberculosis patients either recover or die quicker. Out of 528 cases admitted on account of tuberculosis 95 were outstanding as disabled lives at the end of 1920, while out of 367 insanity cases 195 were outstanding as disabled lives at the same time.

In reference to the tubercular cases Mr. Hunter says: "The sooner the policyholder commences to take 'cure' the greater is his chance of recovery. If the payment of disability benefits assists him in arranging his finances so that he can take a cure earlier than he could otherwise do, it is to the mutual benefit of the insured and the body of the policyholders. There is a strong feeling from the human side also for this attitude on the part of the company." While the appeal from the human side is always strong we are not convinced that the assistance rendered is of great value. The policies issued by Mr. Hunter's company probably average larger in amount than those of our company, and the disability benefits may be of more value on this account, but the amount of benefit at best is limited, and as tuberculosis in order to be arrested must be properly treated in its incipent stages it is very doubtful whether many claims are presented for incipient cases under total and disability clauses.

Since 1913 the Metropolitan has been maintaining a sanatorium for its tubercular employees. To the end of 1920, 1,163 tubercular patients had entered. These have been classified medically as

incipient cases, moderately advanced cases and far advanced cases. The history of these is shown in the following tables:

HISTORY OF ADMISSIONS TO METROPOLITAN'S SANATORIUM.

Class	Admitted.	Discharged from Sanatorium.			Remaining in Sanatorium Dec. 31, 1920.
		Arrested, Quiescent, Improved.	Unimproved, Progressive.	Died.	
Incipient	665	593	15	7	50
Moderately advanced	444	327	44	34	39
Far advanced	54	8	25	20	1
	1,163	928	84	61	90

AVERAGE STAY IN THE SANATORIUM.

Class.	Arrested, Quiescent, Improved.	Unimproved, Progressive.	Died.
Incipient	.63 years	.62 years	1.42 years
Moderately advanced	.96 "	.81 "	.84 "
Far advanced	1.66 "	1.03 "	.81 "

The incipient cases are sick on the average less than eight months. They constitute nearly 60 per cent. of the cases, and if in practice these claims are not presented as total and permanent disability claims, the majority of tubercular cases receive no help from the disability clauses in their life policies. If the total and permanent disability claim is not presented until the case is moderately advanced or far advanced the beneficial results of financial help to enable them to go to a sanatorium are greatly reduced. Under the old form of contract, where the first allowance is on the next anniversary of the policy, the claims are postponed on the average half a year, and by that time assistance is rather late. To be of real value the financial assistance should be given at the beginning, when the case is in its incipient state, and we do not feel that this is done under the total and permanent disability clauses discussed by Mr. Hunter.

It should not be inferred that we are not in sympathy with the idea of aiding tubercular patients, but believe that any such assistance should be rendered quickly, and in substantial amount. Is it not this desire to have a contract definite in its terms, providing adequate benefits when most needed, that is prompting certain of the life insurance companies to give serious considera-

tion to the general question of accident and health insurance? The apparent popularity of the disability benefit in life policies seems to indicate that the public appreciates the activities of life companies in this line, and has confidence in their contracts.

MR. WILLIAM J. CAMERON:

The keynote of Mr. Hunter's paper is liberality in the treatment of disability claims. This liberality in so far as the total and permanent disability of the insured is concerned is commendable and represents a reasonable interpretation of the contract provisions.

Although the author of this paper did not issue a warning, I feel certain that he would oppose liberality which would result in approval of those claims where there is no good reason to believe that the disability would prove to be of a permanent nature. The introduction of new provisions whereby continuous total disability for more than three months shall thereafter be presumed to be permanent may create a tendency towards excessive liberality in the treatment of claims under provisions in which permanent disability is not thus defined.

If a claimant having policies in two companies is granted the benefit in one company under the three months' continuous total disability clause and is refused the benefit in the other because the policy provisions require the insured to be permanently disabled, it is going to be a difficult matter to explain to the insured's satisfaction the different interpretations of permanent disability and to convince him that the two companies have acted with equal fairness. As a result there is bound to be a tendency towards excessive liberality in cases of this kind so as to avoid public opinion adverse to the company's interests in the community. A similar situation may arise if the insured holds policies issued by the same company at different times with this difference in their provisions as regards permanent disability. For this reason I believe that a company should not grant the more liberal benefits to outstanding policies issued prior to the introduction of the three months' continuous total disability clause because the courts might reason that the definition of permanent disability contained in the one policy was equally applicable to the other policy issued at the same time in which permanent disability was not defined.

The other phase of liberality referred to by Mr. Hunter relates to practical questions of a general nature which arise in connection with the approval of disability claims. The policies generally provide that the benefits will begin to accrue only after satisfactory proof of disability has been submitted. Mr. Hunter advocates going beyond the contract by dating back the benefits to the date of disablement. In deciding questions of this nature we should not overlook the purpose of the disability benefits, namely,

to prevent the lapsing of insurance when it is most needed and to provide financial assistance to a limited extent especially to those in moderate circumstances. If the benefits accrue from the date of total disablement then the insured is entitled to reinstatement of a policy lapsed during total permanent disability of the insured and in addition to receive the disability benefits accrued since disablement. Under such conditions the company should restore a policy after the insured's death if it were lapsed during the total and permanent disability of the insured. This is in line with the purpose of disability benefits, but there are two objections which must be considered.

In the first place, as Mr. Hunter points out, this necessitates the distinction between the insured's last illness in the nature of an acute temporary disease and a disease which would normally result in permanent total disability. This distinction could hardly be made clear to a jury and we might eventually be obliged to waive all premiums falling due during the last illness of the insured.

Secondly, if we date back the benefits to the date of total permanent disablement we establish a precedent to which the courts will probably hold us. Consequently we will eventually find that we are in no better position in this regard than if we made it a policy provision that benefits accrue from the date of disablement and in addition we lose the advertising value from an agency point of view. It is quite often a difficult task to establish the date on which the insured became totally and permanently disabled, for instance, in the case of a person developing tuberculosis. This is the reason for the present provisions of our contracts. Before changing these provisions or adopting the practice of dating back the benefits we should consider the effect in cases of this nature, which constitute the greater portion of disability claims.

If the policy stipulates that benefits shall accrue from the date on which proof is submitted provided there has been no default in payment of premiums, it is questionable whether the company would be justified in making such radical modifications in the policy provisions. Those policyholders who chose policies without the disability provisions participate in the profits (if any) from the disability feature but they are also obliged to share the losses which may result from that phase of the business. It is our duty, acting as trustees of the policyholders' funds, to maintain equity between the various classes of policyholders exercising our humane instincts only so far as the provisions of the policy permit us, assuming of course that these provisions are fair to the general body of policyholders.

In the discussion of Mr. Hunter's previous paper pertaining to claims for disability benefits, it was pointed out that individual companies had experienced a lower rate of disability, a higher rate

of recovery and a higher death rate among disabled lives than the experience from which "Hunter's Disability Tables" were derived. The more liberal treatment of claims will result in an increase in the rate of disability and a decrease in the death rate among disabled lives with a higher rate of recovery. I hope that the discussion will reveal the more recent experience of the companies in so far as it relates to the adequacy of "Hunter's Disability Tables."

From the introductory matter of Mr. Hunter's paper I infer that he approves of an investigation of the combined disability experience of the life insurance companies at some future date. I have no reason to doubt the advisability of postponing such an investigation until we have passed through the initial stages in the development of this business. We should reach the point where there is much more uniformity in the disability benefit as well as in the treatment of claims. Moreover, we would not be justified in assuming the adequacy of a disability experience compiled from the statistics of the companies during the first few years under the benefit. The exposures at the young ages are much greater in proportion than if the benefit had been granted twenty years ago on a volume of business equal to that on which it is now being issued. As a result we probably have a greater percentage of claims due to tuberculosis now than we shall have some years hence when the exposures for the age group, 40–60, will constitute a much larger part of the total exposure than at present. The aggregate rate of disability regardless of age may therefore be reduced but we may expect an increase in the percentage of claims due to diseases such as insanity, paresis, paralysis, cancer and heart disease, in most of which we shall experience a much greater average duration of disability. It is then a question of whether the reduction of tuberculosis claims which we know have a comparatively short average duration due to recoveries, and a high death rate will fully offset from a financial point of view the smaller increase numerically in claims due to the diseases enumerated above with a relatively longer duration of disability.

Assuming that this Society will undertake an investigation of the combined disability experience of the companies at some later date, it would be desirable to have a large number of companies participate so that the data would be as comprehensive as possible. If the companies were called upon to furnish their experience at this time, the data pertaining to disability claims would be readily available in probably every instance, but what about the exposures under the benefit? This point was brought to my attention by reading the questionnaire with reference to the methods of valuation of disability benefits recently received from the New York Insurance Department by the various companies of that state. The purpose of this questionnaire apparently is to ascertain

whether some uniform method of valuation based on certain groupings and averages is feasible or not. I am heartily in accord with this idea provided the groupings are arranged with a view to securing exposures for a disability experience. It seems that these groupings should provide for a classification by year of issue and groups of ages at issue such as 29 and under, 30–39, 40–49, 50 and over, for the purpose of both valuation and disability experience with a further classification for valuation purposes only by groups of plans, such as Life (including long term endowments), Limited Payment Life (considered as twenty-payment life), and other Endowments (considered as twenty-year endowment).

It is quite likely that the Insurance Department would be glad to have the cooperation of the members of this Society or a Committee appointed for the purpose in developing a uniform method of valuation based on averages and groupings which would preserve the statistics in a form suitable for a disability investigation.

MR. A. A. RYDGREN:

Mr. Hunter calls attention to the difficulties involved in deciding what constitutes permanent total disability, and cites the practice of the New York Life in allowing permanent total disability claims.

The main difficulty is to determine whether a total disability will be temporary or permanent. The judgment of both the field examiner and the persons passing on a claim and the degree of liberality of the company, must frequently be the deciding factors as to whether the claim shall be allowed; consequently there arises a difference in treatment of similar cases among various companies and perhaps also, to a lesser degree, in the same company.

It is highly desirable that all companies granting the benefit, arrive at some agreement as to what constitutes permanent total disability. The situation would be intolerable, where the same person had a disability claim allowed by one company but not allowed by another company using the same policy provisions; and this situation will arise from time to time unless some definite formula be adopted.

The policies of a number of companies now eliminate altogether the element of judgment as to what constitutes permanent disability, by covering total temporary disability that has existed for a specified time. This is a step in the right direction. Yet we still have the old type of disability contract to reckon with; and it seems to me that the adoption of the new type of contract by some of the companies will tend to further increase our difficulties under the old type of contract, unless we adopt, in respect of the old type of contract, a practice even more liberal than the present practice of the New York Life.

I wonder, for instance, what the New York Life will do when the same policyholder claims disability benefits under both the old and the new types of contract, and proves that he has been totally disabled for three months on account of rheumatism. Will it allow the claim under the new contract and postpone action for another three months under the old contract? Bear in mind that the old contract does not specify a six months' waiting period. It is easy enough to explain to an insurance expert that the old type of contract contemplates allowing disability benefits only when total disability has existed for sixty or ninety days and at the end of that time is presumably permanent, whereas the new type of contract contemplates allowing disability benefits when total disability has existed for ninety days regardless of whether it appears to be temporary or permanent; but it will be exceedingly difficult to satisfy the average policyholder that the company, which refuses to allow his claim, is treating him fairly when the same company or another company allows his claim under another type of contract. In order to maintain our reputation of fair dealing, may we not be compelled to adopt the principle, even under the old type of contract, that where total disability has existed for the sixty or ninety day waiting period specified in the contract, the disability benefit shall be allowed to accrue, regardless of whether disability appears to be temporary or permanent?

Mr. Hunter also states that the practice is developing to make disability benefits accrue from the time the insured became totally and permanently disabled. Although the policy may provide that disability benefits shall accrue from the time of filing due proof, this departure from the terms of the policy is warranted in those cases where the policyholder was either ignorant of his rights or was unable to exercise his rights under the policy. I do think, however, that a company should not allow disability benefits during the first 60 or 90 days of total continuous disability where, according to the terms of the contract, the disability benefit becomes available only when disability has been total and continuous for 60 or 90 days. If a company were to date back the disability benefits to the time when the insured became disabled, especially under the new type of contract, where the disability benefit becomes available when disability has been total and continuous for 90 days, regardless of whether it appears to be temporary or permanent, then the company would be putting a premium upon disability lasting slightly more than 90 days. In other words, where a policyholder either through ignorance or disability, has not availed himself of the disability benefit at the earliest time he became entitled to it, the company should allow the disability benefit to accrue from the time when he could have had it, according to the terms of the contract; that is, sixty or ninety days after he became disabled.

Mr. Hunter's paper is timely. Out of the experience of the New York Life and other large companies, a practice, in respect of allowing disability claims, has developed and probably is still developing which is much more liberal than that originally contemplated. In all probability this development will continue and the future will see a practice even more liberal than the present practice of the New York Life. There can hardly be a question but that a company should construe its disability provisions in the most liberal manner possible and compute its premiums accordingly.

Mr. Hunter's contribution will be invaluable, especially to the smaller companies, whose disability experience is not extensive enough to be used as a basis for the establishment of general principles in handling the difficult and unusual cases; and we are all greatly indebted to Mr. Hunter for again giving us the benefit of the vast experience of the New York Life. I am sure that the smaller companies, at least, would not be far wrong in adopting the practice of the New York Life as their own.

(ORAL DISCUSSION.)

MR. JOSEPH H. WOODWARD:

It has occurred to me in listening to this discussion that a great deal of the difficulty which we are having in arriving at a definition of what constitutes disability, may be explained by the history of the development of the clause,—more specifically, by the order in which the different kinds of disability benefits have been introduced. The existing definition of total permanent disability was devised originally for use in connection with the waiver of premium benefit. The clause has developed so that we now grant annuity benefits and the waiver of premium is of less comparative importance. It seems to me that if the annuity benefit had been the first disability feature to be introduced into a life insurance policy, the clause would probably have been a very different one from what it is today. It is likely that the benefit would have followed the lines of a non-cancellable accident and health policy with a thirteen weeks' exclusion period and that it would not indemnify for the shorter disabilities at all. It would commence to pay indemnity after a man had been disabled for a period of thirteen weeks and if he were then totally disabled it would continue, from that time on, to indemnify him until he either died or recovered and there would be little difficulty in defining the benefit under those conditions. The real social value of the permanent and total disability clause lies not so much in its indemnification for short periods of disability ending in death as in providing that those major disabilities, which for the individual may constitute a financial catastrophe, are provided against with the utmost clearness and certainty.

MR. HENRY MOIR:

Some of the State laws provide that *permanent* and total disability may be granted in connection with a life insurance policy. Accordingly when we grant this benefit which becomes effective after three months' sickness, we are practically saying that if the disability last for three months we consider it to be permanent and total. There is a distinction there that we should always bear in mind. Mr. Woodward says, when the law does not agree with your viewpoint, get the law changed; but more often we have to take the legal aspect and conform to it as best we can. I am a little fearful of an open departure from contractual relations. I think we must adhere closely to the contract and to legal definitions. If a company breaks its contract on one point, you can never be sure but that the courts may construe some other point in favor of a plaintiff. Courts take a peculiar view of contracts when one party or the other has gone outside the contract relations. I am therefore a little fearful of our going too far in liberality, that is, to the extent of going outside of, or waiving conditions in, our contracts. Liberality in definition as to what may constitute permanent and total disability may be safe, and is ethically fair and just, since the clauses provide for possibility of recovery; but when it comes to going beyond the policy contract as to the date when the benefit accrues, there is a possibility of dangerous precedents which might be carried much further than we would want to go in the future.

In his first table Mr. Hunter gives both numbers and percentages. I am sorry he did not feel justified in giving us numbers in other tables also, where percentages only are stated. For example, we should like to know the number of disallowed claims in relation to the number allowed. Some of the percentages relate to very small numbers, and therefore must not be taken as proving much, being only a general guide. This applies particularly to the three tables giving percentages of deaths and recoveries. For example, 4 per cent. of deaths under the head of *Dementia Praecox* in the second year means 3 deaths only, and 6 per cent. recoveries would apparently represent 4 or 5 such recoveries. The table relating to paresis is the most definite of the three, although it is based on 88 cases only. It shows the percentage of death to be 38 per cent. the first year, 41 per cent. the second year, and 44 per cent. the third year. Accordingly there would be 34 deaths the first year, 22 the second, and 14 the third, making 70 deaths in all in three years out of 88 cases. Therefore paresis is not a very serious cause for disability, since death follows so soon after. Personally I want to express my very warm appreciation of this paper,—it is invaluable to all of us to have such papers for reference, giving both comfort and guidance in our own difficulties.

Someone has asked just what is the significance of my statement that some of the state laws provide that total and permanent disability could be granted in connection with a life insurance policy. I take it that, while in those states we can grant permanent disability benefits as part of the life insurance contract, we could not grant temporary illness benefits without special charter or other powers. Accordingly, in using the three months' clause in those states we do not grant temporary disability benefits; we merely introduce a definition of "permanent." In New York State we could grant health, accident, and life insurance under one charter.

(AUTHOR'S REVIEW OF DISCUSSION.)

MR. ARTHUR HUNTER:

The discussion of my paper has been exceedingly interesting, and many points of value to the companies have been brought out. It does not seem advisable to take up the controversial points and to enter into an extended discussion of them as some of these questions involve a matter of personal opinion which may be changed with the increase of our knowledge. The passage of time will probably greatly decrease the number of these controversial points. I shall content myself with the following comments.

We cannot expect such a large percentage of recoveries among our policyholders disabled from tuberculosis as among the employees of the Metropolitan Life Insurance Company because the former probably do not go to a sanitarium in as early a stage of the disease as the latter; in addition, our policyholders have not usually the advantages of such excellent treatment as in the Metropolitan sanitarium.

With regard to Mr. Cameron's suggestion that the companies "might eventually be obliged to waive all premiums falling due during the last illness of the insured," we have not encountered any serious difficulty. The fact that a man dies from a disease does not prove that the disease was likely to cause permanent total disability.

The reason for omitting the percentage of disallowed to approved claims is, that such a percentage would not be of value as many claims were made which obviously did not come within the most liberal interpretation of the policy. Such a percentage would largely represent the relation between the number of cases in which the policy conditions were misunderstand and the number of approved claims.

Convertible Term Business.

BY

FREDERICK H. JOHNSTON.

The results of an investigation which I have just had made into the Convertible Term business of the company with which I am connected are, I believe, of sufficient importance and interest to lay before you.

The class of Term business considered was on the Ten-Year plan with the option of conversion within seven years; taking in the issues of the years 1909 to 1913, inclusive, and following the business up through 1920, so that the convertible period on all policies under observation had expired by the time the investigation was completed.

The number of policies coming under observation was 19,042, covering $82,394,195 of insurance. The disposition within the convertible period of all Term policies issued was as follows:

	Per cent.
Converted to some other form of insurance	30.15
Terminated by lapse	46.63
Terminated by death	2.12
Existing at the end of seven years	21.10
	100.00

Conversions.

The conversions were made, by policy years, as follows:

Policy Year.	Conversion of Number Originally Issued, Per cent.
1	2.49
2	1.69
3	1.66
4	1.76
5	2.18
6	4.02
7	16.35
	30.15

Of the total number of policies converted, 47 per cent. were dated back to the original date and 53 per cent. were converted as of current date. The kinds to which conversions were made were as follows:

	Per cent.
Whole Life	57
Limited Payment Life	38
Endowments	5

Reduction in amount of converted policies was on the average about 9 percent; the heaviest reduction being among those converted to some form of Endowment insurance.

Mortality Experience before Conversion.

The rate of mortality under the term policies before conversion was remarkably favorable, especially in view of the fact that the epidemic years 1918–1919 fell within the period of the investigation. The following table shows, by numbers and amounts, the ratio of actual to expected loss by the American Experience Table of Mortality, within the period of seven years, on policies which had not been converted:

Policy Year.	Per cent Actual of Expected Number.	Amount.
1	29.07%	28.38%
2	55.26	46.36
3	49.62	54.64
4	43.66	40.66
5	65.67	83.39
6	79.41	92.31
7	72.96	59.63
All	53.69%	54.74%

Mortality Experience after Conversion.

The experience after conversion was necessarily limited as to amounts exposed to risk and length of time of exposure. This must be borne in mind in considering the following tables, which have been prepared on both bases of the American Experience table and the AM Select table, allowing for duration from original entry.

Expected Deaths by American Experience Table of Mortality.

Policy Year After Change.	Expected Loss.	Actual Loss.	Per cent.	Expected Loss.	Actual Loss.	Per cent.
	By Number of Policies.			By Amounts of Insurance.		
Changed during 1st or 2d Calendar Year.						
1st five	23.21	7	30.16	$ 80,985	$ 22,000	27.17
6th and subsequent	12.07	9	74.55	40,088	33,524	83.63
Total	35.28	16	45.35	$121,073	$ 55,524	45.86
Changed during 3d or 4th Calendar Year.						
1st five	31.33	15	47.88	$130,049	$ 69,385	53.35
6th and subsequent	6.80	8	117.65	25,488	34,000	133.40
Total	38.13	23	60.32	$155,537	$103,385	66.47
Changed during 5th Calendar Year.						
1st five	15.19	20	131.67	$ 61,764	$ 91,024	147.31
6th and subsequent	1.02	1	98.04	2,496	2,000	80.37
Total	16.21	21	129.55	$ 64,260	$ 93,024	144.76
Changed during 6th to 8th Calendar Years, inclusive						
1st five	88.55	116	130.99	$352,749	$496,064	140.63
6th and subsequent	.45			1,498		
Total	89.00	116	130.34	$354,247	$496,064	140.03
Changed during all years combined.						
1st five	158.28	158	99.82	$625,547	$678,473	108.46
6th and subsequent	20.34	18	88.50	69,570	69,524	99.93
Total	178.62	176	98.53	$695,117	$747,997	107.61
Attained Age 39 and Under.						
1st five	57.76	35	60.60	$187,783	$115,016	61.25
6th and subsequent	6.79	4	58.91	17,828	6,000	33.65
Total	64.55	39	60.42	$205,611	$121,016	58.86
Attained Age 40 to 49, inclusive.						
1st five	61.22	58	94.74	$259,712	$254,917	98.15
6th and subsequent	7.75	5	64.52	30,299	41,524	137.05
Total	68.97	63	91.34	$290,011	$296,441	102.22
Attained Age 50 and over.						
1st five	39.30	68	173.03	$178,052	$308,540	173.29
6th and subsequent	5.80	6	103.45	21,443	22,000	102.60
Total	45.10	74	164.08	$199,495	$330,540	165.69

Expected Deaths by AM Table Allowing for Duration from Original Entry.

Policy Year After Change.	Expected Loss.	Actual Loss.	Per cent.	Expected Loss.	Actual Loss.	Per cent.
	By Number of Policies.			By Amounts of Insurance.		
Changed during 1st or 2d Calendar Year.						
1st five	13.342	7	52.47	$ 47,603	$ 22,000	46.22
6th and subsequent	8.607	9	104.57	29,233	33,524	114.68
Total	21.949	16	72.90	$ 76,836	$ 55,524	72.26
Changed during 3d or 4th Calendar Year.						
1st five	19.854	15	75.55	$ 84,328	$ 69,385	82.28
6th and subsequent	4.796	8	166.81	18,772	34,000	181.12
Total	24.650	23	93.31	$103,100	$103,385	100.28
Changed during 5th Calendar Year.						
1st five	10.610	20	188.50	$ 44,880	$ 91,024	202.82
6th and subsequent	.785	1	127.39	1,989	2,000	100.55
Total	11.395	21	184.29	$ 46,869	$ 93,024	198.48
Changed during 6th to 8th Calendar Years, inclusive.						
1st five	64.394	116	180.14	$263,578	$496,064	188.20
6th and subsequent	.354			1,245		
Total	64.748	116	179.16	$264,823	$496,064	187.32
Changed during all years combined.						
1st five	108.200	158	146.03	$440,389	$678,473	154.06
6th and subsequent	14.542	18	123.78	51,239	69,524	135.69
Total	122.742	176	143.39	$491,628	$747,997	152.15
Attained Age 39 and Under.						
1st five	30.872	35	113.37	$104,254	$115,016	110.32
6th and subsequent	3.653	4	109.50	9,727	6,000	61.68
Total	34.525	39	112.96	$113,981	$121,016	106.17
Attained Age 40 to 49, inclusive.						
1st five	41.747	55	131.75	$175,271	$254,917	145.44
6th and subsequent	5.439	7	128.70	21,628	39,770	183.88
Total	47.186	62	131.39	$196,899	$294,687	149.66
Attained Age 50 and over.						
1st five	35.581	68	191.11	$160,864	$308,540	191.80
6th and subsequent	5.450	7	128.44	19,884	23,754	119.46
Total	41.031	75	182.79	$180,748	$332,294	183.84

Comparing the results shown in the above tables with those shown on pages 11 and 12 of Volume II of the American-Canadian Mortality Investigation for the same classes, the experience of this company shows the same general tendency of adverse selection at conversion, but is much more unfavorable. This is in part due to the fact that the epidemic years of 1918–1919 are included. However, the following table showing deaths by causes does not exhibit a greatly abnormal number of deaths from influenza or pneumonia, but it does show a large proportion of deaths from degenerative diseases.

Convertible 10-Year Term.

Issues of 1909–1913.

Deaths after Conversion Prior to December 31, 1920.

Cause of Death.	No.	Amount.
Typhoid fever	3	$12,000
Influenza	12	33,754
Tuberculous diseases	11	49,000
Venereal diseases	1	1,000
Cancer	8	37,000
Rheumatism	1	2,000
Diabetes	2	4,000
Alcoholism	1	5,000
Apoplexy	9	28,262
Paralysis	6	37,000
Heart diseases	9	64,294
Pneumonia	11	26,000
Appendicitis	6	26,000
Stomach and intestinal diseases	6	11,000
Liver diseases	4	36,000
Peritonitis	2	6,000
Urinary diseases	31	164,885
Accidents	19	55,016
Homicides	1	3,000
Suicides	6	32,516
All other causes*	27	114,270
	176	$747,997

Miscellaneous Causes.

	No.
Ulcers	2
Graves disease	2
Goitre	1
Anæmia	4
Arterio sclerosis	3
Mastoiditis	1
Pellagra	1
Epilepsy	1
Blood poisoning	1
Insanity	1
Sleeping sickness	2
Angina pectoris	3
Meningitis	2
Hemorrhage into pericardium	1
Empyema	1
Cellulitis	1
	27

Conclusions.

Bearing in mind the restricted data on which some of the foregoing figures are based, the general result is more indicative than conclusive, but the following deductions seem reasonable:

First: That with proper care in selection a low mortality during the term period may be looked for;

Second: That the mortality under early conversions and at the younger ages will not be much above normal;

Third: That the mortality under business converted towards the close of the period and at the higher ages will be considerably over normal for a number of years;

Fourth: That out of the saving from the term insurance mortality a proper amount should be withheld to take care of the heavier mortality under converted policies;

Fifth: That there should be no let-up in the care with which such business is selected. Where there is any doubt about an applicant some form of permanent insurance should be offered, for even though the modification, such as to Whole Life, may seem slight, a larger proportion would remain on the company's books, tending to offset some of the adverse selection.

Discussion of Preceding Paper.

(WRITTEN DISCUSSION.)

MR. J. E. FLANIGAN:

Mr. Johnston is to be thanked for the thorough analysis which he has made of the Ten-Year Term business of the Prudential. In general I agree with the conclusions quoted in the paper. A close study of the figures has brought home clearly several points in connection with Convertible Term business which were rather impressions heretofore.

Approximately thirty per cent. of the Term business was converted and I believe this is as high as the average of most companies. The lapse, approximately forty-seven percent, is not surprising, as we have known that the lapse upon Term business was extremely high. I am convinced that the proportion of business exchanged can be materially increased, and the proportion of business lapsed materially decreased if each Home Office will persistently try to educate its salesmen to canvass all Term policies for exchange frequently after the Term insurance has been written, especially in the early policy years. The average salesman is inclined to let his Term business go until toward the close of the convertible period before making any serious effort to exchange it. Mr. Johnston's figures show that over half of the exchanges were made in the seventh policy year and when looked at from the standpoint of business exchanged to the exposure for each policy year, the percentage is even more striking.

Forty-seven percent of the exchanges were made as of original date and forty-three percent to the Limited Payment Life, or Endowment plans, and I should judge that most of those changed as of original date were to the Limited Payment Life or Endowment basis. Unless the exchange is made to such policy forms or unless it is made shortly after the issue of the Term contract, it would seem to me as if it would be better on the whole to urge the salesmen to make the exchanges as of current date, because when dated back to the original age, where a considerable period of time has elapsed, loans are almost invariably used in connection with the exchange—a condition which I would not consider healthy unless the number of premium payments was shortened considerably thereby.

Despite the fact that there are some influenza losses and losses growing out of an attack of influenza contained in the experience, it nevertheless seems as if the mortality experienced upon the converted business is extremely heavy. The mortality to be experienced upon such business in any company will depend very largely

upon the company's attitude toward Term business. If the sales force is trained energetically to sell Term insurance only as a last resort, and then with the idea that it is to be later exchanged to a permanent basis, it will tend to lessen the selection against the company, as there should be a large percentage of business exchanged, and of course it goes without saying that the more persistent the salesmen are in canvassing for such conversions, the greater will be the percent of business exchanged and the lighter the selection against the company.

This latter factor is of great importance, as the greatest cause for selection against the company in connection with the Convertible Term business is not directly from the conversions, but from the fact that a great deal of the lapsed business upon the healthier lives has been converted to permanent insurance, but by agents of other companies, the rejected risks being advised to continue the Term insurance as such or to change it. I know a great many life insurance salesmen who would consider it very unethical to twist business which is upon a permanent basis, but who consider it perfectly legitimate to twist Term business from any company.

It is not quite clear to me how the fifth recommendation under "Conclusions" contained in the paper would lessen the selection against a company on its entire business, although of course it would make the mortality better in the Term group. Our company has followed this recommendation very strictly, but with the idea of aiding the agent to place a permanent form of insurance. I have found that many of the agents are in a much better position to place a Whole Life or some other permanent form of contract when they know they cannot have the Term insurance.

MR. OLIVER W. PERRIN:

Although not sufficient in scope to justify definite conclusions, the convertible term experience presented by Mr. Johnston is extremely interesting. The trend that it exhibits is in accordance with expectation and should give pause to any contemplated liberalizations in convertibility privileges.

It may be noted in passing that the conversions made during the sixth to eighth calendar years (exposed for the first five policy years of the converted policies) represent about 60 percent of the total expected deaths and, as compared with the first to fifth calendar years combined (first five policy years) are strongly indicative of adverse selection. Whatever effect the epidemic may have had upon these figures should, of course, be more pronounced at the younger ages, and, accordingly, one gains the impression that the evidence of adverse selection at the older ages due to the option of conversion is not weakened by the fact that the epidemic years fell within the period of investigation.

In connection with the conversions during the sixth to eighth calendar years above referred to, it would be interesting to have a separate statement of the mortality ratios for each of the first five policy years, as this might throw more light upon the question of the proper length of the period to be allowed for conversion without medical re-examination. A study of the practices of the different companies in this respect shows considerable differences; the conversion periods on ten-year convertible term policies, for example, vary from five years to seven and even to the full term period of ten years. This lack of uniformity shows the need of further investigation on the basis of more comprehensive data.

The experience of the Penn Mutual is not available in similar form for comparison with that of the Prudential. But so far as term mortality in general is concerned, it shows a consistently lower mortality than under business of all classes. Up to the year 1907, the outstanding term business was almost wholly on term plans that were renewable as well as convertible, and term mortality, both prior and subsequent to 1907, while lower than the general mortality of the company for all attained ages, has been slightly higher for attained ages under 40. This statement holds true up to the year 1918; since then an opposite tendency has developed,—due largely, it is believed, to the decreasing proportion of the renewable terms which are now in the aggregate only about 15 percent of the total outstanding term business, and which are exposed almost wholly at attained ages over 40. The Penn Mutual's conversions as of current date are classed as new business, and the new business mortality is investigated each year, both inclusive and exclusive of such conversions. As it covers only one-half year's exposure, however, and combines all durations, it throws little, if any, light upon Mr. Johnston's conclusions; with this caution as to the heterogeneous character of the data, it may be stated that, measured by the American Experience Table, it has averaged in recent years about double the new business mortality, exclusive of conversions.

The distribution of conversions between calendar years would be somewhat affected by such factors as the efforts of the management to secure early conversions, particularly the practice of allowing commissions. The Penn Mutual, in common with some other companies, grants full first commissions (without adjustment) on conversions as of current date when the conversion is dated two or more years from the issue of the term policy. This has resulted in a substantial increase in the percentage of conversions made during the third calendar year and should have some effect upon the incidence of mortality.

Mr. Johnston's results have an important bearing on the dividend scale for term policies with the conversion privilege, as persistently heavier mortality after conversion, such as seems likely

to occur at the older ages, should be taken into account in determining the mortality factor.

MR. SAMUEL MILLIGAN:

It has been impossible, for business reasons, in the limited time at my disposal to prepare a written discussion of this important paper, and Mr. Craig has kindly consented to present a few points which have been passing through my mind after reading this paper.

It is a matter for congratulation that Mr. Johnston has seen fit to give us this experience. The number of current problems to be solved in a progressive life office at the present time, all more or less involving to some extent the question of adverse selection, give to this paper an importance altogether out of proportion to its brevity, and make it all the more necessary that the paper be fully discussed.

The present-day tendency towards writing insurance on the Group principle, without medical examination, or with medical examination which, for individual business, is not considered sufficient, requires the most careful underwriting practices. The results as shown in this paper on carefully selected business with a thorough medical examination bring forth clearly the tremendous importance of eliminating adverse selection. It would seem to be well established that where theoretically there can be adverse selection, then if adequate statistics can be compiled such adverse selection will be found to exist. In the convertible term business there are many opportunities to select against the company, and the experience of Mr. Johnston's company seems to bear out the fact that in each one of the several ways in which adverse selection may occur, it has occurred. The number of conversions increase almost without interruption by policy years, reaching a maximum of 16.35 percent in the final policy year in which the privilege can be exercised, which means that the further from examination the more distinctly can the insured exercise judgment advantageous to himself as to his future longevity. The majority of the conversions were to the cheaper forms of insurance, and where the conversion was made to endowment policies the amount of insurance was on the average less than when the conversion was to a cheaper form of insurance. The experience distinctly shows that the mortality on policies converted at the higher ages and in the latter policy years is less favorable than that on the younger ages and early policy years. The author believes that with proper selection a low mortality during the term period can be looked for, but recommends that out of the savings during this period a fund be laid aside to take care of the excess mortality on the converted policy. Term policies have comparatively small premiums, and owing to the small reserve the excess interest

earnings are of little consequence, which means that a considerably large proportion of the savings in mortality must be used to help defray acquisition expenses. It is questionable, therefore, how much of a fund could be set aside to provide for the excess mortality on the converted policies.

The low percentage of conversions in the early policy years, and also as a total, raises the question as to how much pressure was brought to bear to cause conversion. Mr. Johnston could with benefit I think tell us just what steps were taken for an active conversion campaign on this business. If conversions were not actively canvassed, it is possible that if they had been, a much larger proportion of conversions would have resulted, with a correspondingly better average mortality among the converted policies.

The question naturally arises from a reading of this paper as to the advisability of actively canvassing term insurance, especially under this particular plan. An experience which shows but 30 percent conversions at the end of seven years, leaving as a maximum not more than this percentage of business in force at the end of ten years, and the past experience on this business indicating that it will continue to show heavy mortality, does not seem to be very satisfactory. The proportion of term business which a company places upon its books depends to a great extent upon the attitude of the company towards the issuance of this class of business. If they look favorably upon its issue, they will get it. If not, their proportion of term business will be very small, and this being so why not write regular policies other than term, and at the end of ten years have a much larger proportion of the original issue in force, and in force as good business? In our own company on policies issued in 1910 there was 68 percent in force at the end of 1920. The advisability of changing our practices and converting 68 percent of good business at the end of ten years into 30 percent of bad business has never been demonstrated to the satisfaction of the company.

MR. J. S. ELSTON:

We are all indebted to Mr. Johnston, and the Prudential, for his contribution of the experience on Term policies before and after conversion, particularly for the latter which will be of interest and great value to all actuaries because it throws light on important questions on which many have in the past been forced to theorize as they had little or no empirical basis upon which to base their conclusions.

The experience before conversion, as presented, appears very favorable, but it is difficult to draw conclusions about it because it is based upon the American Experience Table which is so at variance with the true mortality rate that one needs must be

Mortality Experience on Premium-paying Term Policies.

Issues of 1910–1920—Exposure of 1910–1920.

By Calendar Year of Risk.

Year of Risk.	Mean in Force.		Actual Deaths.				Ratio Per cent. of Actual to Expected Deaths.							
			Incl. Influenza.		Excl. Influenza.		Incl. Influenza, AM.		Incl. Influenza, Amer.		Excl. Influenza, AM.		Excl. Influenza, Amer.	
	No.	Amount.	No.	Amount.	No.	Amount.	No.	Amt.	No.	Amt.	No.	Amt.	No.	Amt.
0	24,861	$129,786,670	51	$388,742	41	$350,149	57.6	80.9	22.0	31.3	46.3	72.8	17.7	28.2
1	37,191	183,399,224	160	982,183	134	806,183	100.6	118.3	45.1	54.3	84.2	97.1	37.7	44.6
2	24,706	114,380,756	133	701,886	111	593,886	102.4	109.7	54.8	60.3	85.5	92.8	45.7	51.0
3	17,862	78,124,760	93	457,446	78	373,446	92.4	96.4	52.0	56.1	77.5	78.7	43.6	45.8
4	11,930	50,809,032	62	362,620	57	339,620	85.8	109.0	50.8	67.0	78.8	102.1	46.7	62.7
5	5,934	23,405,425	23	106,000	23	106,000	58.8	62.9	37.4	42.0	58.8	62.9	37.4	42.0
6	2,466	8,977,684	14	64,000	14	64,000	80.5	95.3	53.6	65.5	80.5	95.3	53.6	65.5
7	1,151	3,422,172	13	40,000	11	38,000	149.4	147.7	103.2	104.2	126.4	140.3	87.3	99.0
8	748	2,146,733	9	25,500	7	22,500	150.0	141.0	105.9	102.5	116.7	124.4	82.4	90.4
9	383	1,015,985	5	23,000	5	23,000	156.3	257.3	104.2	190.7	156.3	257.3	104.2	190.7
10	122	302,500	....	.....	....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Select	122,484	$579,905,867	522	$2,998,877	444	$2,569,284	88.5	102.5	43.8	51.5	75.3	87.8	37.3	44.1
Ultimate	4,870	15,865,074	41	152,500	37	147,500	112.6	122.8	76.6	86.2	101.6	118.7	69.2	83.4

sceptical of results based upon it. Of course, the main difficulty is almost obviated on these figures as the division between policy years which would allow for the difference due to selection is given, but of almost equal importance is the difference in age as the mortality at the youngest ages is only a comparatively small proportion of the American Experience whereas at the older ages it approaches the American Experience.

I regret that the company with which I am connected has no exactly comparable experience worked up, but such experience as we have as given in the table on page 477 may be of interest.

This experience is by calendar years, the exposure being based upon the mean of the "In Force" at the beginning and the end of each calendar year and the deaths being those incurred by calendar year. Of course, this is an approximate method used because when the system is once started it gives the results desired comparatively easily. The American Male Mortality rates were graduated both by age and duration which thus produces six select years, the year "0" covering perhaps somewhat less than half a year on the average and the year "5" including approximately one-half a year on the select rate and one-half year on the ultimate but being grouped herein as select.

This experience covers all premium-paying Term policies instead of merely the 10-Year plan with the option of conversion within seven years. It, therefore, covers 10-Year Renewable Term policies issued before 1918 and 5-Year Renewable Term policies issued thereafter, as well as 5-Year Non-Renewable Term issued before 1918 and 10-Year Non-Renewable Term issued for the whole period. 10-Year Term policies, however, constituted about 75 per cent. of our Term Business in force at the end of 1920 and the great bulk of this was our 10-Year Non-Renewable Term policy issued with the option of conversion within eight years. As there has been a rapid increase in our business in recent years, it follows that the bulk of experience in this table is upon our 10-Year Term policy.

Some explanation should be made of the mortality ratios given excluding Influenza. These were obtained by deducting Influenza, Broncho-Pneumonia and Pneumonia claims incurred during October, November and December, 1918. The ratios are, therefore, somewhat too low as all such claims would not have been excluded if we had had any practicable way in determining which were normal and which were abnormal. No such Influenza claims occurring later, however, were excluded.

Our experience, therefore, may be considered favorable during the select period but unfavorable during the ultimate. Of course, as our business is so recent, there is a comparatively small amount of ultimate exposure, and it should be noted in a discussion of this paper that the highest ratios shown are partly on our 10-Year Renewable Term.

For the purpose of computing premiums, dividends, etc., an

estimate must be made of the effect on all policies issued of the higher mortality on the comparatively few policies converted. This might be obtained by combining the experience after conversion with that before conversion, but the results would be so dependent upon the relative mixture of policies of different duration in the experience that the results would not be applicable to other companies.

It would be decidedly interesting to compare the experience on policies converted as of original date with those converted as of present date, as it would seem that there is a considerable possibility of difference in selection against the company under the two plans. As about half of the experience is on each plan, it would be valuable to know the comparative experiences.

Mr. Johnston's conclusions appear amply warranted and as they are conservatively stated after deduction in a scientific manner, I believe they should be given full weight. The counterpart for non-participating insurance of Mr. Johnston's fourth point should be mentioned, that premiums, therefore, should be computed bearing in mind that heavier mortality should be expected after conversion.

MR. ARTHUR HUNTER:

The paper by Mr. Johnston conveys valuable information to the members of the Society, especially in a year when the demand for term insurance is increasing.

In determining the percentage of conversions the policy of the company with regard to term insurance would have a great effect. A company, for example, which refused to grant term insurance unless there was a strong conviction on the part of the agent that the policy would be converted within the next two or three years would have a very different experience from the company which granted term insurance freely. The rate of conversion would also depend upon the practice of the agent in keeping periodically before the insured the advisability of converting his policy to a more permanent form. Furthermore, the procedure adopted by the company a few months before the conversion period expires would have a considerable influence on the conversion rate. One company might assume that its agents would attend to the matter, while another might make a vigorous campaign from its home office to convince the insured of the desirability of making the change. Investigations made in 1918 showed the following rate of conversion under 10-Year Term policies with a 5-year convertible period:

Policy Year.	Percentage of Policies Exchanged.
1st	½%
2nd	1½
3rd	1
4th	3
5th	14

With regard to the mortality during the 10-year period, our experience prior to the influenza epidemic in 1918–19 showed a mortality approximately equal to that of the American Men Table. In the selection of the term business the standard in force at that time was more rigid than for Ordinary Life policies, any cases rated above 105 percent being considered ineligible for term insurance.

Concerning the lapse rate, I am sorry that Mr. Johnston has not given such rate by policy years. Our experience showed a lapse rate of 27 percent at the end of the first year, of 10 percent for each of the years from the second to the fifth inclusive, and of 8 percent from the sixth to the ninth year inclusive. The high lapse rate is largely explained by the fact that the business was taken out for temporary accommodation.

In interpreting our experience it may be well to remind the reader that the term policies issued by us for a number of years have been only one-half of 1 percent of the total number of policies issued. As the average amount of these policies, however, was over $5,000, this represented slightly more than 1 percent of the total amount of new insurance issued.

MR. J. R. LARUS, JR.:

Those of us who received the results of the American Men investigation as regards the mortality under converted Term policies as an indication that there was a negligible selection exerted by holders of these contracts, cannot but be surprised by the unmistakable evidence of high mortality after conversion submitted by Mr. Johnston. Instead of very favorable mortality, we are now confronted with a ratio of one hundred and fifty-two percent of the normal. The wide divergence does not seem to be due to any difference in methods between the two investigations, for even when the exposures given in the American Men investigation are weighted to accord with those in Mr. Johnston's company the same wide divergence appears.

It would appear as though the insuring public is becoming more and more alive to its privilege of selection against the insurance company, and that especially at the upper ages many policyholders are converting Term contracts with perfect knowledge of impaired insurability. The fact that the average insurance agent is gradually becoming more of an expert in his line and more able to advise his clients intelligently is undoubtedly a contributing factor. At the upper ages insurance is expensive, and it is without question easier for an agent to persuade an impaired risk to convert, than to persuade one who still knows himself to be in good health. This selection at the upper ages was an outstanding feature in the American Men investigation as regards the mortality under policies issued upon the expiry of a Renewable Term; it

is worthy of notice that Mr. Johnston shows a still greater selection at these ages under policies issued to take the place of Terms which would have at least three more years to run. This fact points strongly to an increase in self-selection.

It seems quite probable that the self-selection exerted through conversion would evidence itself in an abnormally high first year mortality, and that a company's experience with such a group would be increasingly more favorable. In that case, the method employed by Mr. Johnston in allowing all policies to pass from observation on a certain date would, to some degree at least, produce unnecessarily high mortality percentages. For example, out of the first five years' experience on the policies converted at the end of seven years, the first policy year would have more than twice the normal amount of influence, owing to the fact that many of the policies would pass from view before the end of the first five years. Even with an adjustment to cover this, however, the total amount of extra mortality appears to be considerable.

The company with which I am connected has not a sufficiently large volume to produce any significant results, although it may be interesting to note that the mortality under all 10-Year Term policies without examination within the last five years has been remarkably low—eleven deaths, with an expected, according to the American Men Mortality Table, of sixteen.

As Mr. Johnston states, his results may be more indicative than conclusive; at any rate they certainly make one wish to see similar figures prepared by other large companies so that we may know whether his conclusions apply equally well throughout the insurance world.

(AUTHOR'S REVIEW OF DISCUSSION.)

MR. F. H. JOHNSTON:

In closing the discussion of my paper on convertible term business I wish to thank those who have discussed the paper for their careful analysis of it, and the additional points which they have brought out.

I agree with Mr. Flanigan that it is generally advisable to convert the term policy as of the current date, and is to the policyholder's advantage except at some of the higher ages.

With regard to Mr. Perrin's suggestion that it would be interesting to have a separate statement of the mortality ratios for each of the first five policy years, I may say that the data were so limited that such a separation would have been of little practical value.

While the tables given by Mr. Elston are not strictly comparable with those given for the Prudential, it is evident that the renewable term business has shown the same tendency to an adverse selection.

I agree with Mr. Hunter that the conversion rate would be affected by the attitude of the agents of a company towards such business, and it is obvious that it is desirable to have conversions effected as early as possible in the history of the term policies.

With regard to Mr. Larus's suggestion that the preponderance of first year business after conversion might have exaggerated the mortality rate, I may say that I hardly think that such would be the case. I would be more inclined to look for the heavier mortality a few years after conversion than in the first year.

The question raised by Mr. Craig, on behalf of Mr. Milligan, namely, "Why term insurance anyhow?" brings out a thought which has been in my own mind for some time. Term insurance has its legitimate place in the business, but should, as far as possible, be confined to such place. I think the issuing of term insurance too freely is to be deprecated, for, after all, what is most needed by the insuring public is permanent protection.

An American Sickness Experience Table.

BY

MILES MENANDER DAWSON.

Much greater interest is being taken in these times in the sickness rates likely to be experienced by American insurance companies, especially in view of the growth of the issue of what is now known as "non-cancellable health and accident policies."

Up to about two years ago there were available in this regard scarcely any data except the results of investigations of the experience of establishment funds confined to the employees of one employer and the results of several local investigations made by the Metropolitan Life Insurance Company through its industrial agents, being inquiries as to the sickness conditions in the families of persons insured in the Metropolitan on the industrial life insurance plan.

Health insurance, as insurance covering both sickness and accident has come to be known, has been provided on the weekly or monthly payment plan, with indemnities usually limited to a short period, by companies operating in different parts of the country, and health insurance on the annual premium basis has been provided by the leading casualty insurance companies, usually with the periods for which indemnity was payable somewhat limited but much more liberal than in the other companies, but much of the time with considerable restriction as to the causes of sickness for which indemnity would be paid.

Perhaps under these conditions a large part of the data would not have been especially valuable had the same been collected, for the reason that the tendency now is to cover disabilities for a much longer period, and also to cover all disabilities, practically without restriction as to cause.

There is also a tendency to eliminate some of the earlier weeks of disability, thus diminishing the cost, and to extend the payments throughout the term of disability, so as adequately to take care of policyholders who are so unfortunate as to be disabled for a long period, or permanently disabled.

Two years ago, in the November, 1919, issue of the *Monthly Labor Review,* published by the United States Bureau of Labor Statistics, Washington, D. C., being Volume 9, No. 5, the result of

an investigation of the experience of an American fraternal society, the Workmen's Sick and Death Benefit Fund, with headquarters in New York, was set forth by Dr. Boris Emmet, who was employed by the Bureau to make such investigation.

This information embraced the experience of the society for five years, 1912 to 1916, inclusive, during which period the number of members increased from 40,294 to 44,188.

The total exposure was equal to 185,018 years of individual exposure. No less than 43,485 persons were disabled by sickness for an aggregate of 1,223,324 days, and the average period of disability per annum for each member of the society was 6.6 days, and the average period of disablement was 28.1 days.

About one quarter of the days of disability were due to injury and about three quarters to sickness.

About three fifths of the membership were in three Eastern States, New York, New Jersey and Pennsylvania; about fifteen percent in Illinois, Ohio, Indiana and Michigan, and about fifteen percent in Massachusetts, Connecticut and Rhode Island.

The members were, for the most part, hand workers, distributed in the different trades and industries as shown on pages 22 and 23 of the *Monthly Labor Review* of November, 1919. About ten percent of them were laborers, occupation not specified; 8.7 percent were machinists; 6.3 percent were carpenters, and not so large a proportion as five percent were of any other single occupation.

The following table shows the experience arranged according to groups of ages:

Age Group.	Total Number of Disability Days.	Total Number of Members (exposure).	Number of Disabled Persons.	Average Number of Disability Days per Member.	Average Number of Disability Days per Disabled Person.
Under 20 years.....	2,108	406	127	5.2	16.6
20 to 24 years.....	34,296	7,168	1,778	4.8	19.3
25 to 29 years.....	76,619	15,267	3,574	5.0	21.4
30 to 34 years.....	106,162	21,886	4,862	4.9	21.8
35 to 39 years.....	155,209	27,496	6,197	5.6	25.0
40 to 44 years.....	196,206	30,746	7,104	6.4	27.6
45 to 49 years.....	206,860	31,579	7,150	6.6	28.9
50 to 54 years.....	189,850	25,484	6,044	7.4	31.4
55 to 59 years.....	146,777	16,229	4,168	9.0	35.2
60 to 64 years.....	80,459	6,689	1,859	12.0	43.3
65 to 69 years.....	25,361	1,843	557	13.8	45.5
70 yrs and over.....	3,417	225	65	15.2	52.6
All ages.....	1,223,324	185,018	43,485	6.6	28.1

Taking this table as a basis and operating upon the figures in the fourth column, I have caused a sickness experience table to be deduced, graduated by years of age. In doing this I have taken the number of days at ages below 30 as a constant of 5 and have graduated from age 30 on by means of King's method, which brought out results as follows:

Central Age.	Days Disabled Per Annum.
32	4.806
37	5.637
42	6.401
47	6.541
52	7.633
57	9.070
62	12.307
67	13.800

Starting with this graduation, I have regraduated the table by finite differences and have thereby brought out the following graduated table of days per annum lost by sickness, embracing only the weeks of disability up to the end of the eightieth week, the limit of the experience:

Age.	Days Disabled Per Annum.	Age.	Days Disabled Per Annum.
15	5.0	43	6.3
6	5.0	4	6.4
7	5.0	45	6.5
8	5.0	6	6.6
9	5.0	7	6.7
20	5.0	8	6.8
1	5.0	9	7.0
2	5.0	50	7.2
3	5.0	1	7.4
4	5.0	2	7.6
25	5.0	3	7.8
6	5.0	4	8.1
7	5.0	55	8.4
8	5.0	6	8.7
9	5.0	7	9.1
30	5.0	8	9.5
1	5.1	9	9.9
2	5.2	60	10.3
3	5.3	1	10.7
4	5.4	2	11.2
35	5.5	3	11.7
6	5.6	4	12.3
7	5.7	65	13.0
8	5.8	6	13.8
9	5.9	7	14.7
40	6.0	8	15.7
1	6.1	9	16.8
2	6.2		

There has also been an investigation of the mortality experience of the Workmen's Sick and Death Benefit Fund, resulting in the following graduated table:

Age.	Number Living.	Number Dying.	Age.	Number Living.	Number Dying.
20	100000	359	59	65395	2064
1	99641	410	60	63331	2178
2	99231	424	1	61153	2293
3	98807	411	2	58860	2409
4	98396	394	3	56451	2523
25	98002	391	4	53928	2618
6	97611	396	65	51310	2695
7	97215	423	6	48615	2755
8	96792	455	7	45860	2800
9	96337	486	8	43060	2819
30	95851	520	9	40241	2852
1	95331	542	70	37389	2889
2	94789	562	1	34500	2933
3	94227	581	2	31567	2970
4	93646	605	3	28597	2990
35	93041	634	4	25607	2958
6	92407	671	75	22649	2831
7	91736	709	6	19818	2686
8	91027	741	7	17132	2510
9	90286	771	8	14622	2307
40	89515	791	9	12315	2103
1	88724	805	80	10212	1900
2	87919	827	1	8312	1693
3	87092	864	2	6619	1465
4	86228	904	3	5154	1239
45	85324	966	4	3915	1008
6	84358	1039	85	2907	791
7	83319	1109	6	2116	603
8	82210	1175	7	1513	454
9	81035	1241	8	1059	329
50	79794	1299	9	730	240
1	78495	1353	90	490	178
2	77142	1419	1	312	127
3	75723	1498	2	185	85
4	74225	1579	3	100	54
55	72646	1670	4	46	31
6	70976	1764	95	15	13
7	69212	1861	6	2	2
8	67351	1956			

Utilizing these two tables, I have caused commutation columns representing this mortality experience and sickness experience, combined, to be computed with interest at 3½ percent.

The commutation columns deduced from the mortality table are as follows:

WORKMEN'S SICK AND DEATH BENEFIT FUND MORTALITY EXPERIENCE—COMMUTATION COLUMNS, 3½% INTEREST.

Age.	D_x	N_x	C_x	M_x
20	50256.6	1091744.3	174.3200	13337.6984
1	48382.8	1041487.7	192.3519	13163.3784
2	46554.3	993104.9	192.1933	12971.0265
3	44787.8	946550.6	180.0003	12778.8332
4	43093.2	901762.8	166.7199	12598.8329
25	41469.3	858669.6	159.8557	12432.1130
6	39907.1	817200.3	156.4248	12272.2573
7	38401.1	777293.2	161.4396	12115.8325
8	36941.1	738892.1	167.7803	11954.3929
9	35524.1	701951.0	173.1511	11786.6126
30	34149.6	666426.9	178.9996	11613.4615
1	32815.8	632277.3	180.2638	11434.4619
2	31525.9	599461.5	180.5948	11254.1981
3	30279.2	567935.6	180.3866	11073.6033
4	29074.8	537656.4	181.4860	10893.2167
35	27910.2	508581.6	183.7541	10711.7307
6	26782.6	480671.4	187.9015	10527.9766
7	25689.0	453888.8	191.8285	10340.0751
8	24628.4	428199.8	193.7070	10148.2466
9	23601.9	403571.4	194.7330	9954.5396
40	22609.0	379969.5	193.0285	9759.8066
1	21651.4	357360.5	189.8021	9566.7781
2	20729.5	335709.1	188.3956	9376.9760
3	19840.1	314979.6	190.1681	9188.5804
4	18978.9	295139.5	192.2437	8998.4123
45	18144.9	276160.6	198.4821	8806.1686
6	17332.9	258015.7	206.2623	8607.6865
7	16540.5	240682.8	212.7129	8401.4242
8	15768.4	224142.3	217.7510	8188.7113
9	15017.4	208373.9	222.2048	7970.9603
50	14287.4	193356.5	224.7244	7748.7555
1	13579.5	179069.1	226.1512	7524.0311
2	12894.1	165489.6	229.1628	7297.8799
3	12229.0	152595.5	233.7404	7068.7171
4	11581.7	140366.5	238.0469	6834.9767
55	10951.9	128784.8	243.2522	6596.9298
6	10338.4	117832.9	248.2548	6353.6776
7	9740.48	107494.54	253.0495	6105.4228
8	9158.05	97754.06	256.9734	5852.3733
9	8591.40	88596.01	261.9918	5595.3999
60	8038.86	80004.61	267.1143	5333.4081
1	7499.93	71965.75	271.7090	5066.2938
2	6974.62	64465.82	275.7992	4794.5848
3	6462.91	57491.20	279.0842	4518.7856
4	5965.30	51028.29	279.7988	4239.7014

COMMUTATION COLUMNS, 3½% INTEREST (*Continued*).

Age.	D_x	N_x	C_x	M_x
65	5483.76	45062.99	278.2884	3959.9026
6	5020.03	39579.23	274.8636	3681.6142
7	4575.41	34559.20	269.9060	3406.7506
8	4150.76	29983.79	262.5504	3136.8446
9	3747.89	25833.03	256.6401	2874.2942
70	3364.49	22085.14	251.1783	2617.6541
1	2999.53	18720.65	246.3808	2366.4758
2	2651.72	15721.12	241.0511	2120.0950
3	2320.99	13069.40	234.4698	1879.0439
4	2008.05	10748.41	224.1158	1644.5741
75	1716.02	8740.36	207.2405	1420.4583
6	1450.76	7024.34	189.9754	1213.2178
7	1211.71	5573.58	171.5259	1023.2424
8	999.22	4361.87	152.3219	851.7165
9	813.11	3362.65	134.1567	699.3946
80	651.45	2549.54	117.1084	565.2379
1	512.32	1898.09	100.8198	448.1295
2	394.17	1385.77	84.2932	347.3097
3	296.55	991.60	68.8785	263.0165
4	217.64	695.05	54.1417	194.1380
85	156.14	477.41	41.0497	139.9963
6	109.81	321.27	30.2350	98.9466
7	75.86	211.46	21.9940	68.7116
8	51.30	135.60	15.3995	46.7176
9	34.17	84.30	10.8538	31.3181
90	22.16	50.13	7.7777	20.4643
1	13.63	27.97	5.3616	12.6866
2	7.81	14.34	3.4671	7.3250
3	4.08	6.53	2.1281	3.8579
4	1.81	2.45	1.1804	1.7298
95	.57	.64	.4783	.5494
6	.07	.07	.0711	.0711

I have caused the commutation columns for the sickness indemnities to be computed on two bases, to wit: with the insurance ceasing at age 65 and the insurance ceasing at age 70, with the following results, both of them computed on the basis that the benefits would be payable at the beginning of the insurance year:

SICKNESS COMMUTATION TABLES.

Age.	$K_x : \overline{65-x}\rceil$	$K_x : \overline{70-x}\rceil$	Age.	$K_x : \overline{65-x}\rceil$	$K_x : \overline{70-x}\rceil$
20	6199680.9	6535636.2	45	1878847.1	2214802.4
1	5948397.9	6284353.2	6	1760905.3	2096860.6
2	5706483.9	6042439.2	7	1646508.2	1982463.5
3	5473712.4	5809667.7	8	1535686.8	1871642.1
4	5249773.4	5585728.7	9	1428461.7	1764417.0
25	5034307.4	5370262.7	50	1323339.9	1659295.2
6	4826960.9	5162916.2	1	1220470.6	1556425.9
7	4627425.4	4963380.7	2	1119982.37	1455937.67
8	4435419.9	4771375.2	3	1021987.21	1357942.51
9	4250714.4	4586669.7	4	926601.01	1262556.31
30	4073093.9	4409049.2	55	832789.24	1168744.54
1	3902345.9	4238301.2	6	740793.28	1076748.58
2	3734985.3	4070940.6	7	650849.20	986804.50
3	3571050.6	3907005.9	8	562210.83	898166.13
4	3410570.8	3746526.1	9	475209.35	811164.65
35	3253566.9	3589522.2	60	390154.49	726109.79
6	3100060.8	3436016.1	1	307354.23	643309.53
7	2950078.2	3286033.5	2	227104.98	563060.28
8	2803650.9	3139606.2	3	148989.24	484944.54
9	2660806.2	2996761.5	4	73373.19	409328.49
40	2521555.0	2857510.3	65		335955.30
1	2385901.0	2721856.3	6		264666.42
2	2253827.5	2589782.8	7		195390.01
3	2125304.6	2461259.9	8		128131.48
4	2000312.0	2336267.3	9		62964.55

From these we have deduced single and annual premiums for a benefit of $1 per diem for the first 80 weeks of disability due to accident or disease, as follows:

Age.	Insurance to Age 65.		Insurance to Age 70.	
	Single Premium.	Annual Premium.	Single Premium.	Annual Premium.
20	$123.36	$5.92	$130.05	$6.11
1	122.94	5.97	129.89	6.16
2	122.58	6.02	129.79	6.22
3	122.21	6.07	129.72	6.28
4	121.82	6.13	129.62	6.35
25	121.40	6.19	129.50	6.42
6	120.95	6.25	129.37	6.49
7	120.50	6.32	129.25	6.57
8	120.07	6.39	129.16	6.66
9	119.66	6.47	129.11	6.75
30	119.27	6.55	129.11	6.84
1	118.92	6.64	129.15	6.95
2	118.47	6.74	129.13	7.05
3	117.94	6.83	129.03	7.16
4	117.30	6.92	128.86	7.27
35	116.57	7.02	128.61	7.38
6	115.75	7.12	128.29	7.49
7	114.84	7.22	127.92	7.61
8	113.84	7.32	127.48	7.73
9	112.74	7.42	126.97	7.86
40	111.53	7.53	126.39	7.98
1	110.20	7.64	125.71	8.12
2	108.73	7.75	124.93	8.26
3	107.12	7.87	124.05	8.40
4	105.40	8.00	123.10	8.56
45	103.55	8.13	122.06	8.72
6	101.59	8.27	120.98	8.89
7	99.54	8.42	119.86	9.07
8	97.39	8.58	118.70	9.26
9	95.12	8.75	117.49	9.47
50	92.62	8.92	116.14	9.68
1	89.88	9.11	114.62	9.91
2	86.86	9.30	112.92	10.15
3	83.57	9.50	111.04	10.40
4	80.01	9.72	109.01	10.67
55	76.04	9.95	106.72	10.95
6	71.65	10.18	104.15	11.25
7	66.82	10.43	101.31	11.55
8	61.39	10.67	98.07	11.87
9	55.31	10.92	94.42	12.20
60	48.53	11.17	90.32	12.54
1	40.98	11.42	85.78	12.90
2	32.56	11.70	80.72	13.29
3	23.05	11.99	75.04	13.70
4	12.30	12.30	68.62	14.14
65			61.26	14.62
6			52.72	15.13
7			42.70	15.66
8			30.87	16.22
9			16.80	16.80

The chapter on "Disability Rates and Distribution" in the report of the Ohio Commission on Health Insurance containing a study of disability data, including the data of this Society, by Dr. H. W. Kuhn, may furnish valuable information for computing the proportion of the foregoing premiums requisite to cover health insurance payable during other periods than 80 weeks.

Legal Notes.

BY

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Change of Beneficiary: (Daly *vs.* Daly, Court of Appeals of Maryland, 113 Atl. Rep., 643.) The policy involved was a policy of group insurance paid for by the employer, with the right to insured to change the beneficiary limited to certain of preferred classes and if consented to by the employer. The insured, at the time the policy was taken out, wished to make his fiancee the beneficiary, but this did not come within the rules, consequently, he made his father beneficiary. After being married, the insured went to the officer of the employer having charge of the insurance of employees, and asked to have the beneficiary changed to his wife. This officer, however, did not at that time have the blanks and later in the press of work forgot the insured's request, and the insured died before anything was done. Both the father and the wife claiming the proceeds, the company filed a bill of interpleader.

The court held that the wife was entitled to the proceeds just as if the change of beneficiary had been completed. The following extract shows further facts and the reasoning of the court:

"The insured is not only expressly authorized by the certificate or policy issued to him, and by the policy issued by the society to his employer to change the beneficiary, but according to the plan of insurance adopted by his employer, and which is referred to in the contract between the employer and the assurance society, where his status is changed by marriage, he is required to change the beneficiary by naming his wife as the person to receive the benefits of his policy. In pursuance of the right expressly reserved to him in his certificate and in accordance with the plan of insurance adopted by his employer, Mr. Daly, the insured, applied to Mr. Spear, the agent of the employer, who had charge of the insurance department of the employer, to make the change in his certificate by making his wife the beneficiary, and the only reason it was not done at once was because Mr. Spear did not

have the blanks which were to be furnished him for that purpose. He promised the insured to give him a blank as soon as he got them, but this he neglected or failed to do because he overlooked it. There can be no doubt of the insured's desire and intent to change the beneficiary or that he did all in his power to effect the change, and the only reason a more formal application was not made, and noted on the insurance register of the society, was because the society or the employer had failed to furnish its or their agent the blanks used for that purpose, or because its or their agent failed to give him the blank in accordance with his promise to do so. Under such circumstances the claim of Patrick Daly, whose interest in the policy was subject to the right of the insured to change the beneficiary, should not be allowed to prevail over that of his widow, for whom the insured clearly intended the fruits of his policy, and to whom it should be awarded by a court of equity upon the principle we have stated.

It is urged on the part of the appellee that, as the policy provided that the change of beneficiary should be effective upon the entry of the same upon the insurance register of the society, and as the statute of New York required the assent of the society to such a change, no change of beneficiary could be accomplished without such entry and assent. But in this case the suit is between the claimants, and the society has declared its willingness to pay the fund to the one the court decides is entitled to it. Neither the society nor the employer is resisting the claim of the widow, and under the plan of insurance adopted by the latter and recognized by the society the insured was required to make the change in favor of his wife."

While the case is somewhat extreme in giving effect to the intention of a change of beneficiary not actually carried out during the lifetime of the insured, the decision seems in spirit to be in accord with the general line of decisions upon change of beneficiary.

CHANGE OF BENEFICIARY: (Reid *vs.* Durboraw, United States Circuit Court of Appeals. Fourth Circuit. 272 Fed. Rep., 99.) The policy in question had the ordinary clause giving the right to change the beneficiary upon written request to the home office to take effect when endorsed by the company on the policy. The policy was originally payable to the insured's sister, but upon his marriage he wrote to the company stating that he wished it made payable to his wife. Blanks were sent to the insured and were received about the time he was starting on a trip for the summer and got into baggage that was put in storage so that they

were inaccessible. He wrote again, sending his annual premium and indicating that he desired to change. Later he executed the forms of request, but for some reason neglected to forward the request and the policy to the company. He died of influenza after a short illness in the fall after the correspondence had taken place. The sister and the insured's wife both claimed.

In the United States District Court it was held that the change was effected (*T. A. S. A.*, XXI, 496).

The Circuit Court of Appeals reversed this for reasons appearing in the following extracts from the opinion:

"But the power to change the beneficiary is a power of appointment, and the terms of its exercise are fixed by the contract between the insurer and the insured; not alone for the protection of the insurer, but of the insured as well. The court has no power to change that contract by changing the conditions upon which the exercise of the power of appointment is limited. The utmost extent to which the courts have ever gone is to effectuate the intention of the insured when he has done all that he could to comply with the conditions, and has been prevented by circumstances beyond his control from meeting the requirements."

"Regrettable as it may be, we see no escape, either on principle or authority, from holding that no reasonable effort was made to exercise the power of changing the beneficiary in the method contracted for, and that the original appointment of the sister as beneficiary must stand."

"PROVISION FOR SETTLEMENT FOR LESS THAN FACE OF POLICY": (First Texas State Ins. Co. *vs.* Smalley et al., Supreme Court of Texas, 228 S. W. Rep., 550.) There is a statute in Texas prohibiting the issuance of any life insurance policy containing a provision for a mode of settlement at maturity of less value than the amount insured on the face of the policy, etc.

The policy was an industrial policy for $172. Immediately following the promise to pay $172 upon the death of the insured, and upon the face of the policy, was a condition that in event of the death of the insured within twelve months of the date of the policy as a result of any of certain named diseases, the liability of the company should be one-half of the amount stated. The insured did die, within twelve months, from one of the specified diseases. The company tendered $86 in payment. Suit was brought for the full amount of $172, and the statute mentioned was invoked.

The court held that this statute applied to industrial policies as well as others and that the provision of the present policy was inconsistent with the statute. It further held that provisions inconsistent with the statute were rendered void. The judgment of the lower court for the full amount sued for was affirmed.

An interesting point is that the policy form was one which had been approved by the Insurance Department of the state.

Dividend Illustration: (Maddox *vs.* Mutual Life Ins. Co. of New York, Kentucky Court of Appeals, not yet officially reported.) The illustration in question had as a heading "Adapted Illustration" and stated: "The surplus portion, *i.e.,* former results ($10,247), added to the reserve value or incorporated with the equivalent options in this example is to be understood as a sum adapted for purposes of general illustration only, and to be based on actual experience in policy results of the past, and not as pledged hereby in future settlements." It also used in referring to the surplus, the expression, "Surplus Results which may be Apportioned," and further in quoting the figures of cash obtainable at the end of twenty years, the first line giving the reserve stated "Reserve Guaranteed"; the second line illustrating the surplus stated "Former Policy Results." At the end of the twenty-year distribution period the twenty-year dividend was less than the figure of $10,247.00 stated in this adapted illustration and the insured brought suit.

The court held that the company was not liable for the amount stated in the adaptation of the former surplus results in the illustration. It distinguishes this case from the Forman case (see *T. A. S. A.,* XVIII, 101) by several facts, among which was that the statement that the figures were simply for general illustration and not as pledged in future settlements was more prominent than in the Forman illustration and that the figures giving illustrated surplus were in the present illustration followed by the words "Former Policy Results" while the corresponding figures in the Forman illustration were stated as "Cash Surplus."

Other grounds that the illustration also were made a basis for claim by the insured to the larger amount of surplus. Regarding these also the court held in favor of the company and affirmed the judgment of the lower court in favor of the company.

"PARTICIPATING IN AERONAUTICS": (Travelers Ins. Co. *vs.* Peake, Supreme Court of Florida, 89 So. Rep., 418.) The policy, an accident policy, made a specific exemption from the risks covered of death or injury sustained "while participating or in consequence of having participated in aeronautics." The insured made a flight as a passenger and was injured by the fall of the aeroplane. The company denied liability and suit was brought. The company demurred on the ground that the injury was one not covered by the policy. The Supreme Court upheld the demurrer. See also *T. A. S. A.*, XXII, 253.

REQUIREMENT OF INTEREST ON PROCEEDS OF POLICY: (Mutual Life Ins. Co. of New York *vs.* Rodney et al., Court of Chancery of Delaware, 114 Atl. Rep., 163.) The proofs of death were furnished promptly but the company was unable to pay the proceeds of the policy because such proceeds were claimed both by the insured's administrator and his assignee. After eight years a bill of interpleader was filed by the company, the parties not having reached any agreement concerning their respective claims. The question arose whether the company should pay into the court, in addition to the proceeds of the policy, interest from the time of furnishing proofs of death.

The court held that it was not liable for interest as it was not the fault of the company that the policy had not been paid, and that the company was not under obligation to file a bill of interpleader when there were contesting claimants, to neither of whom the company could make payment without risk.

SUICIDE: (Green *vs.* New York Life Ins. Co., Supreme Court of Iowa, 182 N. W. Rep., 808.) The interest of this case is in the fact that the lower court directed a verdict for the company on the ground that the evidence, which was circumstantial, showed that the insured died by suicide, and the fact that this verdict was affirmed by the Supreme Court.

In its decision the court merely reached the conclusion to which a disinterested and impartial person would naturally have come from the evidence, but courts have been so loathe to take from the jury in an insurance case the question whether death resulted from suicide no matter how strong circumstantial evidence there may have been that this case is worthy of note.

PREMIUM TAX: (People ex rel, Metropolitan Life Ins. Co. *vs.* Knapp et al., State Tax Commission, Court of Appeals of New York, 231 N. Y. Mem., 122.) In this case the highest court in New York sustained the Appellate Division in its opinion that annuity considerations are not to be included in determining the amount of the premium tax (*T. A. S. A.*, XXII, 261).

FULL CREDIT TO DECISION OF COURT OF ANOTHER STATE: (Hartford Life Ins. Co. *vs.* Blincoe, United States Supreme Court, 255 U. S., 129.) This was an action brought in Missouri by the beneficiary under an assessment policy. The decision was for the plaintiff on the ground that non-payment of assessment did not work a forfeiture because illegally levied. The Supreme Court of the United States held, in a former appeal, that this action of the state court disregarded a judgment as to the legality of the assessment of the Connecticut court which had jurisdiction of the subject matter and the parties. Upon return of the matter to the state court the trial again resulted in a verdict and judgment for the plaintiff, the state court holding that an additional element entered, in that a tax asserted to have been imposed by the laws of the State of Missouri, but which really was not payable under those laws, was illegally included in the assessment, and that therefore the assessment was void and non-payment did not work a forfeiture.

In the previous decision of the Supreme Court of the United States the Connecticut judgment, as to the power of the directors to levy the assessment, and its effect were the determining factors. The question of the inclusion of the tax was not discussed or even referred to. The court in the present appeal affirmed the decision of the Missouri Supreme Court against the company on the basis of the inclusion of the tax, holding that the question of the tax was one for the Missouri courts. Its reasoning appears in the following extract from the opinion:

"The element of taxes in the assessment was not considered by the Supreme Court and in this court the Connecticut judgment and its effect were the prominent and determining factors. The question of the inclusion of the tax was not discussed or even referred to. The only question considered was the powers given to the directors of the company by the Connecticut charter and the effect that was to be assigned to the Connecticut judgment as that of a court having jurisdiction to decide what powers the

charter conferred or required. It is hardly necessary to say that the tax law of Missouri was no part of the charter. It was a condition the company encountered and became subject to in Missouri."

It would appear that the amount of the tax involved was fifteen cents, which it would seem might easily have been an amount coming under the usual doctrine that the law disregards trifles.

Three judges dissented.

INCONTESTABILITY; INTERPRETATION OF CONTRACT: (Ramsay *vs.* Old Colony Life Ins. Co., Supreme Court of Illinois, 131 N. E. Rep., 108.) The policy was contested on the ground of fraud. It contained a one-year incontestability clause. The death of the insured occurred within the year, but no administrator was appointed until after the end of the year. While the court followed the Monahan case (*T. A. S. A.*, XIX, 104) in holding that, even though the insured had died, any contest of the validity of the policy must be begun within the year, it also held that the time elapsing between the death of the insured and the appointment of the administrator should be deducted in determining when the year in which the company could contest terminated:

"The appellant's right of action to contest the validity of the policy was necessarily in abeyance after the death of the insured until the appointment of an administrator. There was no person in existence to be sued, the estate of the insured being the beneficiary in the policy, until such appointment. There was no person to whom the company could tender the premiums which it had received or against whom it could proceed for the cancellation of the policy."

"Where one party to a contract has by his own act made it impossible for the other party to comply with the contract and thus protect his interest in it, he cannot avail himself of the noncompliance of the other party to enable him to enforce performance. The impossibility of maintaining the suit because no person is in existence who may be sued will not be permitted to work the injustice of depriving the company of its right to maintain an action to cancel the policy at any time within the year after its date. Either the death of the insured must fix the rights of the parties so that the policy, if contestable then, may be contested whenever suit is brought, or the cause of action of the company must be regarded as suspended during the time it is prevented from suing by failure to appoint an administrator, and upon the appointment of an administrator the suit may be maintained,

provided that the whole time allowed the company for that purpose does not exceed one year."

The court speaks as follows of the rule that an insurance policy being drawn by the company is to be construed most strongly against the company as applied to the incontestability clause, which clause was required by the statute of Illinois and was in the language of the statute:

"It is not to be presumed that the Legislature in prescribing the terms of the contract intended that the language used should be understood in a manner favorable or unfavorable to either party, or that it should receive any other than a fair and reasonable construction to carry out the legislative intent that policies of life insurance should be incontestable after two years from their date, without any qualifications except those mentioned in the statute."

False Statement in Application; Period of Contestability: (Plotner *vs.* Northwestern National Life Ins. Co., Supreme Court of North Dakota, 183 N. W. Rep., 1000.) The policy was applied for on the 28th of July. One of the questions and answers was:

"Name all causes for which you have consulted a physician in the last 10 years; illness, name and address of physician, date, duration, any remaining effects. Answer: Appendicitis, Dr. Sweitzer, St. Paul, 1915. 10 days; good recovery."

Notwithstanding the above answer the insured had consulted another physician only one month before the application who had obtained in detail her health history, taken an X-ray, and prescribed for her. One of the questions involved was whether the misrepresentation contained in concealing this consultation avoided the policy.

The court reasoned that the applicant might have forgotten this or not have considered it of sufficient importance to mention; this notwithstanding the fact that the physician had considered the matter of enough seriousness to get the detailed health history and take an X-ray, both of which would have impressed the fact of the consultation on the mind of the applicant.

Another point involved in the case was the question of the incontestability clause. This was a one-year clause. The insured died within the year but no action was taken to avoid or rescind the policy before the end of the year.

The court held following the Monahan decision (*T. A. S. A.*, XIX, 104), that this in any case barred the defence.

What Constitutes Waiver: (Cure *vs.* Midland Life Ins. Co., Supreme Court of Kansas, 198 Pac. Rep., 940.) The policy provided that it should not go into force unless delivered while applicant was in good health. After the application had been approved at the home office of the company and before the policy was delivered the applicant was killed. At the time of the application a note had been given for the premium, and a portion of the note had been paid before the applicant was killed. The note was to be paid in instalments, by the employer of the applicant out of the wages of the applicant. There was a similar arrangement about many of the other employees. After the death of the applicant the remaining instalments of the note were paid together with payments on policies of other employees, and were thus accepted by the company without knowing that they were on the life of this applicant. As soon as it was learned that these payments had covered the premium on the policy in question the company tendered back the amount, which was refused. It was claimed that the receipt, and retention for a time, by the company of the premium constituted a waiver of its defence.

The court held that there was no waiver. Extracts from the opinion state clearly what it seems is the true doctrine of the waiver.

"Instead of an intentional and unequivocal relinquishment of the contract right, there was a consistent insistence that there was no liability on the contract, and an attempt in good faith to return the premium that had been indirectly paid through the agent of Cure's employer."

"Nor is there anything in the case in the nature of an estoppel, as the plaintiff was not misled by the fact that the premium was in defendant's hands for a short time. From the beginning the return of the premium was steadily refused."

. . . . . .

"Of course if the company had knowingly accepted premiums and intentionally recognized the validity of the contract and waived these conditions it would be bound. The evidence does not show such intention, and nothing occurring after his death tends to show an intentional relinquishment of the right nor anything approaching an estoppel to deny liability."

WAIVER OF FORFEITURE: (Kozloski *vs.* Prudential Ins. Co. of America, Court of Errors and Appeals of New Jersey, 113 Atl. Rep., 135.) The policies involved were industrial policies, requiring weekly premiums. The policies lapsed on account of nonpayment of premiums and the period of grace expired. The insured died after the end of the period of grace. The agent, in ignorance of the death of the insured, received the overdue premiums, part of the payment being made on the day of the insured's death and part after the insured's death. The agent had no authority to waive the lapse of the policies.

Claim was made under the insurance, but the company denied liability. The jury in the lower court gave a verdict against the company. On appeal, the court affirmed the judgment, holding that, while the premiums received after the death of the insured were received in ignorance of the fact of that death, the company, on learning of the real situation, had the option of returning the premiums and declaring the policies void, but retained the premiums and by retaining the premiums elected to keep the policies in force.

DUE DATE OF PREMIUM; DAMAGES: (Chestnut et al. *vs.* Security Mutual Life Ins. Co., Kansas City Court of Appeals, Missouri, 232 S. W. Rep., 203.) The policy was dated Dec. 8, 1891. The premiums were payable quarterly. The premium due June 8, 1914, was not paid. Several days later the insured remitted to the company, but the remittance was refused, the insured, however, being given the usual opportunity for reinstatement, of which he did not avail himself. He brought suit for return of premiums paid, with interest, on the theory that the premium in question had been duly paid and in refusing to accept it the company had wrongfully cancelled the contract. The claim that the premium was paid within due time was based upon the theory that the due date of the premium was later than the date stated in the policy. After the policy was taken out, and the application had been transmitted to the home office, the insured was ill with pneumonia, so that until he recovered, the policy could not be delivered, and was actually delivered about January 1, 1892, rather than on the date of the policy, Dec. 8, 1891. It was therefore claimed that the real date of the contract was the date of delivery, this being the date it went into force, and that pre-

miums thereafter were due quarterly from that date. The contract itself specified by the day of the month "December 8th, March 8th, etc." the due dates of the premiums, not making them depend directly upon the date of the policy as they would if the specification had been that premiums were due "on the date hereof and quarterly thereafter."

The lower court gave judgment against the company for the amount claimed, which was considerably more than the face amount of the policy. The Kansas City Court of Appeals affirmed this, holding that the real due date of the premium was each three months from the date that the policy went into force.

This case is very extreme and differs from many of the cases cited in support of the claim in that here the due dates of the premiums were definitely stated as days of the month, and not determined by the date of the policy contract.

Again, the court allowed the recovery of premiums and interest although the contract had been in large part performed on the part of the insurance company by carrying the risk for 23 years, and it would seem that the measure of damages should have been rather the value to the insured of the policy, which could not well under any conditions have reached the amount awarded.

CONDITION OF GOOD HEALTH ON DELIVERY OF POLICY: Mutual Life Ins. Co. of New York *vs.* Shoemake, Supreme Court of Mississippi, 89 So. Rep., 154.) The application contained a provision that the proposed policy should not go into effect unless the first premium was paid and the policy delivered during the continuance of the applicant in good health. The policies were issued in the usual way but after being received by the agent were held for some time without being taken up by the applicant. Later a relative of the applicant asked for the policies and offered to pay the premium, and informed the agent that the applicant was ill with tonsilitis. The agent refused to deliver the policies and after the death of the applicant, which occurred a few days later, suit was brought.

The court held that the policies were never in force.

One of the most interesting features about this case is that there should have been a dissenting opinion. The one giving this opinion apparently considered that one ill in the hospital with tonsilitis was still in good health, on the ground that tonsilitis was

a minor illness. This opinion was in the face of the fact that at the time delivery was asked for insured was not only ill enough to be in the hospital, but so ill that his throat had required to be lanced, and that he died a few days later.

EFFECT OF NOTE GIVEN EXTENDING TIME FOR PAYING PREMIUM: (Robnett *vs.* Cotton States Life Ins. Co., Supreme Court of Arkansas, 230 S. W. Rep., 257.) When the second annual premium became due, the insured was unable to pay it. Hence he paid a small amount in cash, giving a note for the remainder, which note expressly stated that the payment made was a payment for the favor of extending the time of payment of the premium and not toward payment of premium, and that if the note was not paid when due the rights and privileges under the policy would be the same as if the cash had not been paid or the note given. Upon the maturity of this note the insured made a further cash payment and gave a further note for a further extension. When this second note became due it was not paid and five days afterwards the insured died. The amount paid in cash was more than the pro rata of the annual premium to the date of death. Claim was made on the theory that the cash payments made should be treated as premium on the policy, in which case it would have been in force at the insured's death.

The court held that there was a clear and unequivocal agreement on these notes as to just what rights were given, and that in accordance with their agreement, the policy was not in force. One of the points involved in this case was that the grace period did not extend to the payment of the note.

VALIDITY OF NOTE GIVEN FOR PREMIUM: (Wilcox *vs.* Walker, Court of Appeals of Georgia, 107 S. E. Rep., 560.) This was a suit to enforce payment of a note given for payment of first premium. The insured had received and held the policy for a year, and then attempted to avoid payment of the note on the ground that he was unable to read or write and had been induced to take the policy on fraudulent representations.

The court held that he could not defeat payment of the premium when he had held the policy, and enjoyed the benefit of the protection, for a full year.

INTERPRETATION OF MISSOURI STATUTE: (Bothmann *vs.* Metropolitan Life Ins. Co., St. Louis Court of Appeals, 231 S. W. Rep., 1007.) The policy in question had lapsed and some five months afterward the insured died. The policy provided for options on lapse, provided there was no loan on the policy, either (*a*) cash surrender value, (*b*) extended term insurance or (*c*) paid-up insurance, the paid-up insurance being automatic if the owner should not within three months from date of default make any election. The policy also had a specific statement of what was to happen in case there was a loan, such statement reading as follows:

"Any indebtedness to the company under this policy will be deducted from the cash value; and such indebtedness will also reduce the amount of paid-up insurance or the amount continued as term insurance and any pure endowment payable at the end of the endowment term, in such proportion as the indebtedness bears to the cash value at due date of premium in default."

No election was made, so that according to the terms of the policy paid-up insurance for a reduced amount was in force at the death of the insured. Claim, however, was made for the full amount of the policy under the theory that through the effect of the Missouri Non-forfeiture Statute providing for extended insurance, extended insurance was in force. The non-forfeiture statute which provided for extended insurance contained the exception that it would not be applicable in case

"the policy shall contain a provision for an unconditional surrender value at least equivalent to the net single premium for the temporary insurance provided for in such sections, or for unconditional commutation of the policy for non-forfeiture paid-up insurance."

The question before the court was whether the provisions of the policy complied with the Missouri statute, and in particular whether in view of the proviso regarding loans the provision for paid-up insurance was a provision for "unconditional commutation of the policy for non-forfeiture paid-up insurance." The amounts given were greater than those required by the Missouri statute so that the question of these amounts did not enter.

The court held that the terms of the policy were in compliance with the statute in giving non-forfeiture paid-up insurance and that consequently only the paid-up insurance, for which the company had already recognized its liability, was in force.

Compare with Ross *vs.* Capital Life Ins. Co. decided in the Kansas City Court of Appeals, *T. A. S. A.*, XXII, 264.

Missouri Non-forfeiture Law: (Head *vs.* New York Life Ins. Co., Supreme Court of Missouri, 227 S. W. Rep., 429.) This case came up to the Supreme Court of Missouri for the second time following a retrial after a previous decision of the Missouri Supreme Court against the company had been reversed by the United States Supreme Court (*T. A. S. A.*, XV, 374). The United States Supreme Court had held that a loan agreement made by the insured was a New York contract and therefore not subject to the Missouri non-forfeiture law. The loan agreement had stipulated that in case of default in premium and interest the equity in the policy should be applied to purchase paid-up insurance according to the New York law. On the retrial of the case the plaintiff was awarded the amount of the paid-up insurance on this basis and appealed. The Missouri Supreme Court held, however, that the decision of the United States Supreme Court in the previous appeal, and also in the case of New York Life Ins. Co. *vs.* Dodge (*T. A. S. A.*, XIX, 91) upheld the company's standpoint.

Mis-statement of Age; Missouri: (Burgess et al. *vs.* Pan-American Life Ins. Co., Supreme Court of Missouri, 230 S. W. Rep., 315.) The insured had stated his age to be 58 years, whereas it appeared that it really was 63 years. The company offered evidence that it was against its rules to issue a policy at an age above 60 years, and on this as one ground resisted the claim on the death of the insured.

In the lower court a judgment was given against the company. In the Springfield Court of Appeals there was a division of opinion, the majority holding for reversal of the lower court, but on request of the dissenting judge the case was certified to the Supreme Court. The Supreme Court confirmed the judgment of the trial court against the company, quoting with approval from the dissenting opinion of the Court of Appeals which held that the provisions of the statute of Missouri that a policy should not be defeated by misrepresentation in the application unless the matter misrepresented was one that contributed to the death of the insured, and that the question of such contribution was a

question for the jury, applied to a mis-statement of age, hence unless the jury should hold that the difference in age contributed to the death, which the jury did not do in this case, such mis-statement should not in any case defeat the recovery.

Furthermore the opinion quoted discussed the provision in the policy that in case of mis-statement of age the amount payable should be the amount which the premium paid for at the correct age, and quoted apparently with approval, from Burns *vs.* Metropolitan Life Ins. Co. (*T. A. S. A.*, XI, 337), decided in the Kansas City Court of Appeals, which held that the reducing of the amount payable by means of this clause regarding mis-statement of age was in conflict with the statute mentioned unless such difference in age was found by the jury to have contributed to the death.

Representations "Wilfully False": (New York Life Ins. Co. *vs.* Wertheimer et al., United States District Court, 272 Fed. Rep., 730.) The action was in equity to compel the surrender and cancellation of two policies of insurance one of the grounds being misrepresentation in the application. The Ohio statute provides that no answer by an applicant for insurance shall bar recovery,

"unless it be clearly proved that such answer is wilfully false, was fraudently made, that it is material, and induced the company to issue the policy, and that but for such answer the policy would not have been issued, and also that the agent or company had no knowlege of the falsity or fraud of such answer."

Thus relief could not be granted unless the misrepresentations were wilfully made with respect to a material matter, and were relied upon and induced the making of the contract. The insured suffered from paresis, which became acute shortly after the taking of the second of the two policies. In the application for each of the policies he had made the statement that he had not consulted a physician, or physicians, within five years. At the time of the application for the later policy he had consulted physicians several times within a month, and at the time of the application for the earlier policy he had consulted a physician within a year, and had been told of the serious nature of the trouble.

The court held that the conditions required by the Ohio statute for avoiding a policy were fulfilled, and especially that the mis-

representation in regard to such a specific and important fact as the consultation of a physician, under the circumstances of this case, was necessarily wilful, speaking in part as follows regarding this:

"A positive statement of fact falsely made, with respect to a material matter, will, nothing else appearing, be deemed to have been wilfully made and with intent to deceive."

. . . . . .

"If the answer is untrue, and the matter is material, and the maker of the statement necessarily knows that it is not true when he made it, the intention to deceive the insurer is necessarily implied as a consequence of such act."

KNOWLEDGE OF AGENT: (New York Life Ins. Co. *vs.* Patten, Supreme Court of Georgia, 106 S. E. Rep., 183.) A false statement was contained in the application and the question before the court was whether the fact that the agent knew the falsity of this statement amounted to a waiver. The application stipulated that only certain named officers of the company could "modify or discharge contracts or waive any of the company's rights or requirements and that none of these acts could be done by the agent taking the application."

The court held that with this specific provision in the policy limiting the power of the agent, his knowledge did not bind the company.

CHANGE OF BY-LAWS OF FRATERNAL ORDER: (Boynton *vs.* Modern Woodmen of America, Supreme Court of Minnesota, 181 N. W. Rep., 327.) Some years after Boynton became a member of the order a by-law was adopted providing that no presumption of death should arise from disappearance of an insured member until the expiration of his life expectancy. Several years after the adoption of this by-law Boynton disappeared, and seven years having elapsed claim was made and suit brought. One of the grounds of defence was that under this by-law the insurance had not become payable.

The court held that such by-law was unreasonable and void for reasons stated in the following extract:

"At the time the insurance contract in the case at bar was entered into, it was settled law that an unexplained absence of seven years was competent evidence of death, and sufficient to

justify a recovery thereon by the beneficiary. The amended by-law not only abrogates that rule of evidence, and that method of proof of death, in which the insured perhaps can have no vested right, but materially changes the contract in point of substance by imposing upon the beneficiary the burden of continuing the payment of dues and assessments for a long period of time after the lapse of the seven years' disappearance, namely, during the period of the insured's life expectancy. That the change is unreasonable seems the only fair conclusion."

The court noticed that the opposite conclusion had been adopted in Illinois, where the home office of the order was situated, and in several other states.

"ACCIDENTAL MEANS": (Husbands *vs.* Indiana Travelers Accident Association, Appellate Court of Indiana, 130 N. E. Rep., 874.) The insured, while shaking his furnace, was taken with hemorrhage of the lungs, which caused his death within a few minutes. The contract provided for the benefit claimed only if the insured should "through external, violent and accidental means receive a bodily injury which should, independently of all other causes, result in death. . . ." The claim was that the shaking of this furnace required more strength than an ordinary furnace, and that "the wrenching and strain of deceased's body by the violent exertion in shaking the furnace was accidental and unintentional on his part, and was unforeseen and unexpected by him." This would not seem to come under the usual definition of accidental means, since the insured, in shaking the furnace, did exactly what he intended to do and nothing more, and, while in so doing he made an effort which resulted in hemorrhage—an accidental result—death was not caused by an accidental means (see *T. A. S. A.*, XXI, 501). The court held, nevertheless, that the injury was caused by accidental means, reversing the trial court.

(Fane *vs.* National Association Railway Mail Clerks, N. Y. Supreme Court, Appellate Division, 4th Dept., 188 N. Y. Supp., 222.) A railway mail clerk, in lifting a bag of mail, was ruptured. The question involved was the same as in the last case—whether the injury was caused by accidental means. The court held that the means were not accidental.

"The means which the plaintiff used to place the bag were exactly those which he intended to use, and precisely those he

had used on many other occasions. It cannot be said that the means were accidental. The most that can be said is that the result was accidental. He was doing what he meant to do, and doing it in the way he meant to do it. An unexpected result followed, but that result did not follow through accidental means. He was injured from doing what he intended to do and doing it in exactly the way he intended to do it, and the rupture was not the result of accidental means. This conclusion is sustained by many decisions."

This case is directly contra to the one above.

What Constitutes Total Disability: (Aetna Life Ins. Co. *vs.* McCullagh, Court of Appeals of Kentucky, 229 S. W. Rep., 1034.) The insured received an injury to his leg, which resulted in a stiffening of the knee, so that the knee could not be bent, and the leg was shorter than the other. He claimed under an accident policy for total disability. Before the accident, he had been a secretary to his uncle. After the accident, and during the period in which it was contended he was totally disabled, he did no work whatever, and claimed he could not sit at a desk or make regular trips on the street. It appeared, however, that he made almost daily trips downtown, went to the bank to attend to his personal business, and went frequently to moving picture shows and to his clubs.

The court held that the disability was not total but rather partial.

Limitation of Right to Demand Autopsy although Provided for in Policy: (United States Fidelity and Guaranty Co. *vs.* Hood, Supreme Court of Mississippi, 87 So. Rep., 115.) The policy provided that in case of death the company should have the right and opportunity to make an autopsy. The insured died on December 27th and was buried December 28th. The company on learning of the death of the insured demanded an autopsy. This demand was made on January 2nd and was refused. The company contested the claim, one of the grounds being the refusal to comply with the condition of the policy giving the company the right and opportunity to make an autopsy.

The court held that the demand for an autopsy should have been made before the burial of the insured, if at all, and consequently the demand in this case was too late and refusal did not constitute a defence to the policy.

QUESTION WHETHER DEATH WAS RESULT OF ACCIDENT OR SUICIDE: (United States Fidelity and Guaranty Co. *vs.* Blum, United States Circuit Court of Appeals, Ninth Circuit, 270 Fed. Rep., 946.) The policy involved was an accident policy which specifically excluded suicide as a cause of death. A jury had given a verdict against the company, and the case was appealed on the ground of failure to establish accidental death, the claim being that death was caused by suicide rather than accident. The facts were that the insured had suffered serious financial losses, and had been very much depressed thereby. His death was caused by fall from a window of his office, and there was only circumstantial evidence as to the cause. This was chiefly that the insured was a short man, 5 feet 7 inches, that the window from which he fell was about 3 feet 4 inches from the floor, that the width of the sill and the stone coping immediately outside it, which were nearly level, was about 2½ feet, and the entire width, including an outer coping 4½ inches lower, was 43 inches.

The court recognized the fact that the burden was on the plaintiff to prove that death was accidental, but also referred to the fact that the presumption was against suicide, and speculated on the possibility of the insured getting on a chair which was close to the window, and standing or sitting on the sill, and in that way accidentally falling out of the window if taken with a dizzy spell to which he was said to be somewhat subject. On such grounds as this it held that there was sufficient evidence of accidental death for the case to go to the jury and for their verdict to stand.

This would seem an extreme case since the burden of proof was on the plaintiff to show that death was by accident rather than suicide. *T. A. S. A.*, XXI, 228 was the same case but the point involved was different.

RELEASE OF CLAIM UNDER ACCIDENT AND HEALTH POLICY: (Fidelity and Casualty Co. of New York *vs.* Logan, Court of Appeals of Kentucky, 229 S. W. Rep., 104.) The policy provided for benefits for disability resulting from accident, and also for a death benefit to the beneficiary in case death resulted under certain circumstances. The insured suffered an injury, and was disabled for some time thereafter, but was getting somewhat better, and, thinking he had recovered, he accepted a payment

from the company as in full settlement. Some months after, he died, and it was claimed that his acceptance of payment in full settlement did not bar the death benefit to the beneficiary. The court held that undoubtedly the acceptance of a payment in full settlement barred any further recovery on the amount payable to the insured, but did not defeat recovery by the beneficiary for death benefits where there was, as here, a separate provision for such benefits.

ACCIDENT INSURANCE, PROOF OF ACCIDENT REQUIRED: (United States Casualty Co. of New York *vs.* Malone, Supreme Court of Mississippi, 87 So. Rep., 896.) The policy in this case provided for a death benefit where death resulted "directly and independently of all other causes from bodily injury effected solely through external, violent and accidental means." The only evidence that the injury from which death finally resulted was caused by accidental means, was a statement of the insured to a physician. The court held regarding this: "it is a mere self-serving statement. It has no probative value as to such fact. . . . The proof is wholly insufficient to establish liability."

The judgment of the lower court against the company was reversed, and judgment entered for the company.

REPORTS OF THE JOINT COMMITTEE OF THE ACTUARIAL SOCIETY OF AMERICA AND THE ASSOCIATION OF LIFE INSURANCE MEDICAL DIRECTORS.

I.

Standard Mortality Ratios Incident to Variations in Height and Weight among Men (1918).

In the preparation of its report on the Medico-Actuarial Mortality Investigation (1912–14), the committee in charge did not as a rule attempt to interpret the facts brought out therein. It thought that it was justified only in sounding a note of warning wherever in its opinion the results obtained in any group were likely to be so misinterpreted as to lead to errors in selection, either in the direction of too great strictness or of unjustifiable leniency.

In a paper entitled "The Need in Medical Selection of Standards by Which to Measure Border-Line Risks," read in 1916 before the Actuarial Society and also before the Medical Directors' Association by Dr. Rogers and Mr. Hunter, it was suggested that the societies continue the work of the Medico-Actuarial Investigation by preparing and recommending for general use among the companies "standards by which to measure the value of lives for insurance." It was also suggested that the subject of build and family history might be taken up first. These suggestions met with the approval of both societies, and the present Committee was appointed to undertake the work.

It was decided to proceed first with the preparation of tables of standard mortality ratios based on height and weight alone. The principal material available was found in the Medico-Actuarial Mortality Investigation. While the report of that investigation gave the relative mortality at groups of entry ages for various degrees of departure from the average weight, it did not contain a recommendation that the companies use these mortality ratios in the selection of risks.

In Volume II of the Medico-Actuarial Report, pages 23 and 24, there appear tables of percentages of actual to expected deaths at various age groups for all heights combined and for various degrees of departure from the average weight. These tables are based on the material for all heights from 5 feet 3 inches to 6 feet 2 inches, inclusive, and reflect the relative mortality for all policy years combined. The use of such tables, without modification, in the selection of risks is open to objection, because (*a*) the tables do not distinguish between men of varying heights, whereas the data indicated that for either a given number of pounds or a given percentage departure from normal weight the mortality among short men frequently did not agree with that among tall men, nor did either class show the same experience as men of medium height, and (*b*) no adjustment had been made in the tables for the undue preponderance of the experience of the early policy years.

The second feature mentioned—the preponderance of early policy years' experience—arose from the fact that the data in question consisted of the experience on policies issued in the years 1885 to 1908,* inclusive, up to policy anniversaries in 1909. There were thus 24 years of issue whose experience entered into the results for the first policy year, 23 years of issue for the second policy year, 22 years of issue for the third policy year and so on down to the twenty-fourth policy year, the data for which were derived from the issues of 1885 only. No experience was available for policy years after the twenty-fourth.

With regard to the effect of this unduly large proportion of experience on recently selected lives, it is evident that in a group with a relative mortality improving materially with duration the tabulated ratio of actual to expected deaths in that investigation would be higher than the facts warranted. The reverse would be true in the case of a group with a relative mortality increasing with duration. Among underweights, especially at the younger ages at entry, the relative mortality does improve decidedly with increasing duration, while among overweights the relative mortal-

* For lives where the departure from normal weight was small, the data covered issues from 1885 to 1900, inclusive, only. As the mortality ratios of such groups varied little from 100 per cent., no special treatment was adopted for the groups affected, the various methods of modifying the data to obtain a proper representation of the various policy years having a negligible effect on the groups in question.

ity, generally speaking, increases with duration. Several plans were suggested to adjust the disturbance in the mortality ratios arising from these conditions. One was to eliminate the experience of the first five policy years and to construct a table of ratios based only on the sixth and subsequent years, on all risks which at the commencement of the insurance fell into the same height and weight group. A disadvantage of this method was the resulting loss of about 40 per cent. of the data upon which the Committee had to base its conclusions. In the overweight groups, also, the relative rate of mortality in the early policy years was so much better than that of the later years that deriving an average ratio —which was the Committee's object—from the experience after five years from issue would tend to overstate the true excess mortality.

For this reason it was decided, as the data had been tabulated according to quinary or smaller entry-age groups, to consider also a plan for making some correction for the disturbance arising from the undue preponderance of early policy years' experience. This second method provided for reducing the figures for actual and expected deaths of any policy year in proportion to the number of years of issue entering therein. Thus, the figures for the first policy year would be divided by 24, for the second by 23, for the third by 22, and so on. To reduce the necessary labor the policy years were combined into groups 1–5, 6–10, 11–15, 16–20 and 21–24, the respective divisors being 22, 17, 12, 7 and 2½. Experiment indicated that the results so obtained would adequately represent those derivable from the more detailed calculations.

A third method of allowing for the unequal incidence of various policy years' experience used the first five policy years' experience as tabulated and combined the experience exclusive of the first five years by attained ages, proceeding by quinary age groups and averaging mortality ratios. Allowance was made for the fact that the mortality of the later policy years loses in relative importance, because the reserve reduces the true amount at risk and also because deferment for a number of years implies discounting in order to arrive at the relative effect of the experience of such later policy years on the aggregate mortality cost for all durations. To allow for the effect of interest and reserves the average mortality ratio for each quinary group of ages at

entry was obtained by applying a system of weights to the first five years' experience and to the corresponding subsequent attained age groups. These weights were based on ordinary life reserves, with interest at 3½ per cent. An approximate allowance was made for lapses also.

In addition to the data contained in the Medico-Actuarial Investigation, the Committee made use of statistics kindly furnished by the Mutual Life Insurance Company of the experience on their issues from 1885 to 1906, inclusive, carried to the policy anniversaries in 1915, the data on men of medium height (5 feet 7 inches to 5 feet 10 inches, inclusive) covering 31,535 deaths.

With this additional information and with such further data as could be obtained from the experience of other individual companies, the Committee prepared tables of percentages in practicable form for use in the selection of risks which seemed to it to be fairly representative of past experience after giving due weight to the results obtained under the three plans referred to above. The ratios adopted for men of medium height appear in Tables I and II, on pages 517 and 518, and are given both according to number of pounds, departure and to percentage departure from normal weight.

In Tables I and II the mortality ratios among the overweights decrease with increasing age after middle life. This may be due to the fact that the selection practised was doubtless increasingly rigid with advancing age. It will be remembered, moreover, that a constant percentage addition to the rate of mortality would imply an absolute addition rapidly increasing at the older ages. Thus, a 50-per cent. increase in mortality over the American Table means at age 50 about 7 extra deaths per 1,000 at risk; at age 60 it means 13; and at age 70, as many as 30 extra deaths. It is not likely that overweight results in such a large increase over the normal death rate at these old ages, as it is probable that those who did not possess unusual stamina have already been eliminated by death.

The tables for men of medium height having been determined, the next part of the problem was to ascertain the changes which variation in height would call for in the mortality ratios. Use was made of two tables which were already in existence, namely, the graduation by Mr. James F. Little and that by Mr. P. C. H. Papps, appearing in Volume XV, page 324, and Volume XVI,

page 187, of the *Transactions of the Actuarial Society.* These tables were based upon the experience of the Medico-Actuarial Mortality Investigation according to the number of pounds' departure from the average weight, but made no allowance for the influence of the preponderance of early policy years' experience on the mortality ratios, although Mr. Little drew attention to the necessity for adjustment and suggested a plan for making it, which the Committee has adopted. A third table, prepared by a member of the Committee, was also presented, based on the same material. The variation between the ratios in these tables is due to difference in judgment with regard to graduation. There were also prepared for this report two sets of tables by Mr. Little and by Mr. Arthur Coburn, respectively, based on the Medico-Actuarial Investigation, but making allowance for the unequal weight of the various policy years. In addition, the experience of the Mutual Life Insurance Company was used, as was that of the Metropolitan Life Insurance Company.

After careful consideration of the different tables and of the various points involved the Committee constructed the following tables with the object of reproducing as nearly as possible the actual conditions underlying the rather intractable data. These tables show the mortality rates applicable to men of medium height, to short and to tall men, respectively, and the differences between the ratios for short and for tall men and those for men of medium height.

A study of the foregoing tables indicates that there was not a marked difference between short men and men of medium height except for underweights at young ages at entry, nor between the tall men and men of medium height except for the younger ages at entry at all weights and for men distinctly overweight at all ages. It has been suggested that so far as the underweights are concerned, there may be normally a higher mortality among the tall thin men than among the short men of the same *percentage* of underweight. Statistics prepared for the Committee show that tall thin men experience a distinctly higher death rate from tuberculosis than short men of a corresponding percentage of underweight. With regard to overweights, it is suggested that there was probably a more rigid selection among short than among tall men, as among the former the overweight would appear more pronounced than in the case of tall men, who were

TABLE I.

Mortality Ratios According to Departure from Average Weight.

(Departure Expressed in Pounds.)

Men of Medium Height (*5′ 7″ to 5′ 10″*).

Age Group.	Pounds Under or Over Normal Weight.																							
	−40	−35	−30	−25	−20	−15	−10	−5	0	+5	+10	+15	+20	+25	+30	+35	+40	+45	+50	+55	+60	+65	+70	+75
20–24..	131	124	118	113	109	105	102	99	97	95	94	95	98	101	105	110	115	121	127	133	140	149	158	167
25–29..	120	115	111	107	104	102	100	98	97	96	97	99	102	107	113	119	124	130	137	145	153	161	169	178
30–34..	112	108	105	103	102	100	98	97	96	96	98	101	106	112	118	124	130	137	144	152	161	171	181	191
35–39..	104	102	100	99	98	97	96	95	95	96	99	103	108	114	120	127	134	142	150	159	168	177	187	197
40–44..	98	97	96	95	95	95	94	94	94	95	99	104	110	116	123	129	137	145	154	163	172	181	191	201
45–49..	94	93	93	93	93	93	92	93	93	95	99	104	109	115	122	129	137	145	153	162	171	180	190	199
50–53..	92	91	91	91	91	91	91	92	93	95	99	103	109	115	121	127	134	142	150	158	166	173	182	192
54–56..	90	90	90	90	90	90	90	91	92	94	98	103	109	115	120	126	133	140	148	156	163	170	178	187
57–59..	89	89	89	89	89	89	90	91	92	94	98	102	107	113	119	125	132	139	146	153	160	167	175	184
60–62..	88	88	88	88	88	88	89	90	92	94	97	101	106	112	118	124	130	137	144	151	157	164	173	183

TABLE II.

MORTALITY RATIOS ACCORDING TO DEPARTURE FROM AVERAGE WEIGHT.

(Departure Expressed in Percentage.)

MEN OF MEDIUM HEIGHT (*5′ 7″ to 5′ 10″*).

Age Group.	Percentage Under or Over Normal Weight.														
	−30%	−25%	−20%	−15%	−10%	−5%	0%	+5%	+10%	+15%	+20%	+25%	+30%	+35%	+40%
20–24	135	126	118	111	105	100	97	95	95	99	105	112	120	129	140
25–29	125	117	111	106	102	99	97	97	99	105	113	121	131	142	154
30–34	115	109	105	102	100	98	96	97	102	110	119	129	140	152	165
35–39	108	103	100	98	97	96	95	98	104	112	123	134	147	160	174
40–44	102	98	96	95	95	94	94	98	105	115	126	138	151	165	180
45–49	97	94	93	93	93	92	93	98	105	115	126	138	151	165	180
50–53	93	92	91	91	91	91	93	98	105	114	125	137	149	162	175
54–56	91	90	90	90	90	90	92	98	105	114	124	136	148	160	173
57–59	90	89	89	89	89	90	92	97	104	113	123	134	146	158	170
60–62	89	88	88	88	88	90	92	96	103	112	122	133	144	155	167

TABLE III.

Mortality Ratios According to Departure from Average Weight.

(Departure Expressed in Pounds.)

Short Men (Under 5′ 7″).

Age Group.	Pounds Under or Over Normal Weight.																							
	−40	−35	−30	−25	−20	−15	−10	−5	0	+5	+10	+15	+20	+25	+30	+35	+40	+45	+50	+55	+60	+65	+70	+75
20–24	114	109	105	101	98	95	93	92	91	90	90	91	94	98	102	107	112	118	125	133	140	148	157	166
25–29	109	104	101	99	97	95	94	94	93	94	95	98	102	107	113	119	125	132	140	148	156	164	172	180
30–34	104	101	98	97	96	96	95	94	94	96	99	103	109	115	121	127	135	143	151	159	167	177	187	196
35–39	100	98	96	95	95	95	95	95	95	97	102	107	113	119	126	133	141	149	157	167	177	186	196	205
40–44	97	95	94	94	94	95	95	95	96	99	104	109	115	122	130	138	146	154	163	172	181	190	200	209
45–49	95	94	93	94	94	94	94	95	96	99	104	110	116	122	129	137	145	153	161	170	179	188	197	206
50–53	94	93	93	94	94	94	95	95	97	100	105	110	115	121	128	135	143	150	158	165	173	181	189	198
54–56	95	95	95	95	95	95	95	96	98	101	105	110	115	121	128	135	143	149	157	164	171	178	186	193
57–59	97	97	97	96	96	96	96	97	99	102	106	110	115	121	127	134	141	148	155	162	168	175	182	189
60–62	100	99	99	98	98	98	99	100	101	103	106	110	115	121	127	134	140	146	152	158	165	172	179	186

TABLE IV.

Changes in Mortality Ratios According to Height.

Excess of Ratios of Table III (Short Men) Over Ratios for Men of Medium Height.

Age Group.	Pounds Under or Over Normal Weight.																						
	−40	−35	−30	−25	−20	−15	−10	−5	0	+5	+10	+15	+20	+25	+30	+35	+40	+45	+50	+55	+60	+65	+70	+75
20–24..	−17	−15	−13	−12	−11	−10	−9	−7	−6	−5	−4	−4	−4	−3	−3	−3	−3	−3	−2	0	0	−1	−1	−1
25–29..	−11	−11	−10	− 8	− 7	− 7	−6	−4	−4	−2	−2	−1	0	0	0	0	1	2	3	3	3	3	3	2
30–34..	− 8	− 7	− 7	− 6	− 6	− 4	−3	−3	−2	0	1	2	3	3	3	3	5	6	7	7	6	6	6	5
35–39..	− 4	− 4	− 4	− 4	− 3	− 2	−1	0	0	1	3	4	5	5	6	6	7	7	7	8	9	9	9	8
40–44..	− 1	− 2	− 2	− 1	− 1	0	1	1	2	4	5	5	5	6	7	9	9	9	9	9	9	9	9	8
45–49..	1	1	0	1	1	1	2	2	3	4	5	6	7	7	7	8	8	8	8	8	8	8	7	7
50–53..	2	2	2	3	3	3	4	3	4	5	6	7	6	6	7	8	9	8	8	7	7	8	7	6
54–56..	5	5	5	5	5	5	5	5	6	7	7	7	6	6	8	9	10	9	9	8	8	8	8	6
57–59..	8	8	8	7	7	7	6	6	7	8	8	8	8	8	8	9	9	9	9	9	8	8	7	5
60–62..	12	11	11	10	10	10	10	10	9	9	9	9	9	9	9	10	10	9	8	7	8	8	6	3

TABLE V.

Mortality Ratios According to Departure from Average Weight.

(Departure Expressed as Percentage.)

Short Men (Under 5′ 7″).

Age Group.	Percentage Under or Over Normal Weight.														
	−30%	−25%	−20%	−15%	−10%	−5%	0%	+5%	+10%	+15%	+20%	+25%	+30%	+35%	+40%
20–24	115	108	103	98	95	92	91	90	91	94	100	106	113	122	132
25–29	110	104	100	97	95	94	93	94	97	103	110	118	127	138	149
30–34	105	101	98	96	96	95	94	97	102	110	119	128	139	150	162
35–39	102	98	96	95	95	95	95	99	106	115	125	135	147	159	173
40–44	99	96	94	94	95	95	96	101	109	119	130	141	153	166	179
45–49	97	94	93	94	94	94	96	102	110	119	129	140	152	165	178
50–53	95	94	93	94	94	95	97	103	110	119	128	139	150	162	173
54–56	96	95	95	95	95	96	98	103	110	119	128	139	149	160	171
57–59	98	97	97	96	96	97	99	104	110	118	127	138	148	158	168
60–62	101	99	99	98	98	99	101	104	110	118	127	137	146	155	165

TABLE VI.

CHANGES IN MORTALITY RATIOS ACCORDING TO HEIGHT.

Excess of Ratios of Table V (Short Men) Over Ratios for Men of Medium Height.

Age Group.	Percentage Under or Over Normal Weight.														
	−30%	−25%	−20%	−15%	−10%	−5%	0%	+5%	+10%	+15%	+20%	+25%	+30%	+35%	+40%
20–24	−20	−18	−15	−13	−10	−8	−6	−5	−4	−5	−5	−6	−7	−7	−8
25–29	−15	−13	−11	− 9	− 7	−5	−4	−3	−2	−2	−3	−3	−4	−4	−5
30–34	−10	− 8	− 7	− 6	− 4	−3	−2	0	0	0	0	−1	−1	−2	−3
35–39	− 6	− 5	− 4	− 3	− 2	−1	0	1	2	3	2	1	0	−1	−1
40–44	− 3	− 2	− 2	− 1	0	1	2	3	4	4	4	3	2	1	−1
45–49	0	0	0	1	1	2	3	4	5	4	3	2	1	0	−2
50–53	2	2	2	3	3	4	4	5	5	5	3	2	1	0	−2
54–56	5	5	5	5	5	6	6	5	5	5	4	3	1	0	−2
57–59	8	8	8	7	7	7	7	7	6	5	4	4	2	0	−2
60–62	12	11	11	10	10	9	9	8	7	6	5	4	2	0	−2

TABLE VII.

Mortality Ratios According to Departure from Average Weight.

(Departure Expressed in Pounds.)

Tall Men (Over 5′ 10″).

Age Group.	Pounds Under or Over Normal Weight																							
	−40	−35	−30	−25	−20	−15	−10	−5	0	+5	+10	+15	+20	+25	+30	+35	+40	+45	+50	+55	+60	+65	+70	+75
20–24.....	139	133	128	124	120	116	112	110	109	109	108	109	111	115	119	123	128	134	140	146	153	160	168	176
25–29.....	126	122	118	115	112	109	108	107	106	107	108	110	114	118	123	130	136	142	148	155	162	170	178	186
30–34.....	114	111	109	107	106	105	104	104	103	105	107	110	115	121	128	135	141	149	156	163	171	179	188	198
35–39.....	106	104	103	102	102	101	101	101	101	103	106	111	116	122	129	136	144	152	160	169	177	186	195	204
40–44.....	99	98	98	98	98	98	98	99	99	101	105	110	116	123	131	139	147	155	163	171	180	189	198	207
45–49.....	93	93	94	94	95	95	96	97	98	101	105	110	115	122	129	136	143	151	159	167	176	185	193	202
50–53.....	90	90	91	92	92	93	94	95	97	100	104	109	114	120	126	133	140	147	155	162	170	178	187	195
54–56.....	88	88	89	90	90	91	92	94	96	99	103	108	113	118	124	130	137	144	151	159	166	174	182	189
57–59.....	86	86	87	88	89	90	91	93	95	98	102	106	111	116	122	128	134	141	148	156	163	170	177	185
60–62.....	85	85	86	87	88	89	90	92	94	97	100	104	109	114	120	126	133	139	146	153	160	167	174	182

TABLE VIII.

Changes in Mortality Ratios According to Height.

Excess of Ratios of Table VII (Tall Men) Over Ratios for Men of Medium Height.

Age Group.	Pounds Under or Over Normal Weight.																						
	−40	−35	−30	−25	−20	−15	−10	−5	0	+5	+10	+15	+20	+25	+30	+35	+40	+45	+50	+55	+60	+65	+70	+75
20–24.....	8	9	10	11	11	11	10	11	12	14	14	14	13	14	14	13	13	13	13	13	13	11	10	9
25–29.....	6	7	7	8	8	7	8	9	9	11	11	11	12	11	10	11	12	12	11	10	9	9	9	8
30–34.....	2	3	4	4	4	5	6	7	7	9	9	9	9	9	10	11	11	12	12	11	10	8	7	7
35–39.....	2	2	3	3	4	4	5	6	6	7	7	8	8	8	9	9	10	10	10	10	9	9	8	7
40–44.....	1	1	2	3	3	3	4	5	5	6	6	6	6	7	8	10	10	10	9	8	8	8	7	6
45–49.....	−1	0	1	1	2	2	4	4	5	6	6	6	6	7	7	7	6	6	6	5	5	5	3	3
50–53.....	−2	−1	0	1	1	2	3	3	4	5	5	6	5	5	5	6	6	5	5	4	4	5	5	3
54–56.....	−2	−2	−1	0	0	1	2	3	4	5	5	5	4	3	4	4	4	4	3	3	3	4	4	2
57–59.....	−3	−3	−2	−1	0	1	1	2	3	4	4	4	4	3	3	3	2	2	2	3	3	3	2	1
60–62.....	−3	−3	−2	−1	0	1	1	2	2	3	3	3	3	2	2	2	3	2	2	2	3	3	1	−1

TABLE IX.

MORTALITY RATIOS ACCORDING TO DEPARTURE FROM AVERAGE WEIGHT.

(Departure Expressed as Percentage.)

Tall Men (Over 5′ 10″).

Age Group.	Percentage Under or Over Normal Weight.														
	−30%	−25%	−20%	−15%	−10%	−5%	0%	+5%	+10%	+15%	+20%	+25%	+30%	+35%	+40%
20–24	149	139	130	123	117	111	109	108	109	114	121	128	137	147	159
25–29	136	127	120	115	110	107	106	107	111	118	128	137	148	160	174
30–34	123	116	111	108	106	104	103	105	112	122	134	145	158	171	186
35–39	113	107	104	102	102	101	101	105	113	124	137	151	166	180	196
40–44	104	100	98	98	98	98	99	104	113	126	140	155	170	185	202
45–49	97	94	93	94	95	96	98	104	113	125	138	152	167	182	199
50–53	91	90	90	91	92	94	97	103	112	123	135	148	162	176	191
54–56	87	87	88	90	91	92	96	102	111	121	132	145	159	172	186
57–59	85	85	86	88	89	91	95	101	109	119	130	142	155	169	182
60–62	84	84	85	87	88	91	94	99	107	117	128	140	152	165	178

TABLE X.

Changes in Mortality Ratios According to Height.

Excess of Ratios of Table IX (Tall Men) Over Ratios for Men of Medium Height.

Age Group.	Percentage Under or Over Normal Weight.														
	−30%	−25%	−20%	−15%	−10%	−5%	0%	+5%	+10%	+15%	+20%	+25%	+30%	+35%	+40%
20–24	14	13	12	12	12	11	12	13	14	15	16	16	17	18	19
25–29	11	10	9	9	8	8	9	10	12	13	15	16	17	18	20
30–34	8	7	6	6	6	6	7	8	10	12	15	16	18	19	21
35–39	5	4	4	4	5	5	6	7	9	12	14	17	19	20	22
40–44	2	2	2	3	3	4	5	6	8	11	14	17	19	20	22
45–49	0	0	0	1	2	4	5	6	8	10	12	14	16	17	19
50–53	− 2	− 2	− 1	0	1	3	4	5	7	9	10	11	13	14	16
54–56	− 4	− 3	− 2	0	1	2	4	4	6	7	8	9	11	12	13
57–59	− 5	− 4	− 3	− 1	0	1	3	4	5	6	7	8	9	11	12
60–62	− 5	− 4	− 3	− 1	0	1	2	3	4	5	6	7	8	10	11

commonly described as large, big-built men, carrying their weight with ease. It is also suggested that in a certain proportion of the cases of short heavy men, the overweight may be due rather to the legs being short in proportion to the body than to excess of flesh.

It will be noted that the tables arranged by pounds of departure differ materially in character from those arranged by percentages, the general tendency being toward a reduction in the differences as between men of different heights. This arises from the fact that the average weight for the short men is less than for the medium-height men, and the average weight of the latter is in turn less than the average weight of the tall men, so that the same number of pounds' departure represents a larger percentage departure among the short men and a smaller among the tall men than among the medium-height men. As the mortality ratio in general increases with the departure from the average where that departure is important, the result is to cause in the table arranged by pounds of departure a relative increase in the mortality ratios for the short men and a decrease in the ratios for the tall men.

It should be pointed out, however, that rather more accurate results are obtained by the use of the tables according to "number of pounds" variation from average weight than by the table in which the variations in weight are stated as percentages of the normal. The reason for this is that the mortality ratio is usually more nearly constant at varying heights for an absolute than for a percentage departure from normal weight.

Mortality Among Overweights under Insurances Limited to 15 or 20 Years.

A table of mortality ratios for the first 15 or 20 policy years has been prepared, by request, for the use of companies which make a practice of granting short-term endowments to overweight persons at the younger and middle ages at entry. This table takes the form of deductions from the average mortality ratios for all insurance years.

In this connection, it should be pointed out that the use of these lower ratios for endowments would imply somewhat increased ratios for whole life policies. This will be clear when it is remembered that the data as tabulated show the average results on all

kinds of insurances, and, therefore, were the endowment risks with their lower than average experience excluded, the mortality experience on the remaining lives must be higher than the average.

It will be borne in mind that overweight groups show an excessive mortality even in the early policy years, which, of course, is not affected by the form of policy. It is clear that, if a company's actual mortality is uniformly above the tabular, the financial loss under an endowment policy will be less than under a life policy, on account of the smaller net amount at risk. On the other hand, if the actual mortality is below the tabular for some policy years, but above it for others, little, if any, difference in the financial loss may arise as between the endowment and the life policies during a term of fifteen or twenty years.

Attention is called to the facts above stated, in order to avoid any possible misunderstanding.

TABLE XI.

DEDUCTIONS FROM MORTALITY RATIOS OF OVERWEIGHTS FOR POLICIES LIMITING RISK TO FIFTEEN OR TWENTY YEARS.

Excess Weight Expressed in Pounds.

Age Group.	Policy Years.	+30 lbs.	+35 lbs.	+40 lbs.	+45 lbs.	+50 lbs.	+55 lbs.	+60 lbs.	+65 lbs.
20–24.....	1–15	0	2	4	6	9	12	15	20
	1–20	0	2	3	5	8	11	15	20
25–29.....	1–15	2	5	7	9	13	18	24	30
	1–20	1	4	5	7	11	16	20	25
30–34.....	1–15	4	6	7	9	12	16	21	27
	1–20	3	4	5	7	9	12	16	22
35–39.....	1–15	4	7	10	13	16	20	25	30

Excess Weight Expressed as Percentage of Normal Weight.

Age Group.	Policy Years.	+20%	+25%	+30%	+35%	+40%
20–24.....	1–15	0	2	5	9	15
	1–20	0	2	4	8	15
25–29.....	1–15	2	5	9	16	24
	1–20	0	3	7	13	21
30–34.....	1–15	4	7	11	16	23
	1–20	3	5	8	12	18
35–39.....	1–15	5	9	14	19	26

The above deductions from the mortality ratios apply to men of medium height, but may be used without material error for both short or tall men.

Abdominal Girth Greater than Chest Expanded.

The influence of excessive abdominal girth upon mortality was carefully studied in the Medico-Actuarial Investigation, and the results were published in Volume IV (Class 42).

By throwing into a single group all risks 15 per cent. or more overweight with excess abdominal girth, it was found that the mortality, when compared with that of overweights generally, was expressed by the following percentages:

	Per Cent.
Abdominal girth 2 inches or less in excess	105
Abdominal girth more than 2 inches in excess	109

Taking persons at or above the average weight with excess abdominal girth and comparing the results with the corresponding general overweight figures, the following were obtained:

	Per Cent.
15 per cent. or less overweight	108
Between 15 per cent. and 35 per cent. overweight	106
More than 35 per cent. overweight	107

An attempt to subdivide this material for more detailed analysis showed that the results in individual groups were irregular, and it was felt that only the following general deductions were justified:

1. The relative mortality of those with large abdominal girth is greater than the already heavy mortality found to exist among the general body of those of corresponding weight.

2. The relative mortality increases slightly with increasing excess of abdominal girth, notwithstanding the fact that the greater such excess the more rigid was the selection by the Companies.

3. The excess mortality in Class 42 over that among overweights as a whole was practically a constant percentage of the latter.

Had it seemed advisable to accept the ratios given above, it would have been a simple matter, by applying to the graduated tables for overweights generally, to construct tables which might have served as a guide in passing upon such risks. But it was recognized that by reason of the influence of selection upon the experience, the results did not indicate the true excess mortality among overweights with excess abdominal girth. The committee, moreover, had opportunity to view an unpublished experience of a company which had insured overweights with excess abdominal

girth on plans calculated to provide for the additional mortality to be expected, and which therefore had made no specially rigid selection among them. In this experience, a group of risks 30 per cent. to 39 per cent. overweight, with excess abdominal girth, when compared with a similar group without such excess girth, showed the following results:

	Per Cent.
Excess girth not exceeding 1 inch	107
Excess girth 1¼ inches to 2 inches	114
Excess girth 2¼ inches to 3 inches	130

A further group 40 per cent. to 49 per cent. overweight, compared in the same way, gave the following figures:

	Per Cent.
Excess girth not exceeding 1 inch	103
Excess girth 1¼ inches to 2 inches	127
Excess girth 2¼ inches to 3 inches	144

A comparison of these ratios with those given above shows that there was good reason to believe that the results of the former investigation had been considerably influenced by the rigid selection practised by the companies.

Another consideration deserving attention is found in the fact that an analysis of the unpublished experience referred to above shows the following entry age distribution:

ENTRANTS 30 PER CENT. TO 39 PER CENT. OVERWEIGHT.

	Proportion of Entrants at All Ages.		
	Entry Ages 25–39.	Entry Ages 40–49.	Entry Ages 50 up.
Without excess girth	59%	28%	7%
With excess girth	51%	35%	11%

ENTRANTS 40 PER CENT. TO 49 PER CENT. OVERWEIGHT.

	Proportion of Entrants at All Ages.		
	Entry Ages 25–39.	Entry Ages 40–49.	Entry Ages 50 up.
Without excess girth	68%	18%	4%
With excess girth	59%	26%	10%

From the above it is evident that excess abdominal girth is largely incident to advancing years and that a comparison of the mortality ratios of overweight groups, respectively, with and without this impairment, should take into account the relative age distributions of the groups.

Although the amount of material available for study in the unpublished experience here referred to was deemed insufficient to justify publication, results were obtained so in line with that of the Medico-Actuarial Investigation, due allowance being made for the influence of selection and of age distribution, that it was felt that some indication was afforded of the mortality among risks decidedly overweight and with excess abdominal girth. The following table is presented to supply some measure of the extra mortality normally associated with excess abdominal girth. Though the table is based upon scanty data, its use will probably afford a more definite means of determining the effect of this impairment than any other at present available. It must be borne in mind that the extra mortality shown below is in addition to the extra mortality incident to overweight alone:

Abdominal Girth.	30% or Less, or 50 lbs. or Less.			31% to 40%, or 50 to 65 lbs.			Over 40%, or Over 65 lbs.		
	Age Under 40.	Age 40–50.	Age Over 50.	Age Under 40.	Age 40–50.	Age Over 50.	Age Under 40.	Age 40–50.	Age Over 50.
1 inch excess	0	0	5	0	5	10	5	10	20
2 inch excess	0	5	10	5	10	15	10	20	35
3 inch excess	5	10	15	10	20	25	15	35	55
4 inch excess	10	15	25	20	30	40	25	50	75

II.

Functional Heart Murmur and Intermittent Albuminuria (1920).

It was decided by the Actuarial Society of America and by the Association of Life Insurance Medical Directors that an endeavor should be made to obtain the relative mortality in cases of functional heart murmur and of intermittent albuminuria. All the companies represented in these two associations were asked to contribute their data, but, unfortunately, very few were in a position to assist, for two reasons: (1) many of the companies did not accept applicants with functional heart murmur or with intermittent albuminuria; (2) the majority of the companies had not kept a record of such cases, and accordingly it would have been necessary to review the medical papers in every application. The only material therefore available was from the companies which had insured such cases and had kept a record of them. The experience was based upon data contributed by the following companies:

Aetna
Confederation of Canada
Equitable
Imperial of Canada
John Hancock
New York Life
Penn Mutual
Phoenix Mutual
Provident Life and Trust
Travelers
Union Central.

Several of the foregoing companies were not able to furnish their data on both functional heart murmur and on intermittent albuminuria.

Functional Heart Murmur.

The work of collecting the data was commenced about a year ago (in 1919), and accordingly the companies were asked to carry the records to the anniversary of the policies in 1918. The experience covers policies issued in the years 1904 to 1917 inclusive, with the exception of one company which gave a longer experience. The study is based upon policies. In general, the results

applied to the American-Canadian Mortality Investigation were used in the present instance.

It was hoped that there would be sufficient experience to investigate the mortality according to whether the case was (*a*) accepted on the plan applied for, (*b*) limited to a higher priced policy, or, (*c*) taken as an underaverage risk, but the amount of the material did not justify such subdivision.

The following is the Committee's instruction to the companies regarding functional heart murmur:

> The risks reported in this study should be free from any other important impairment; should only include systolic heart murmurs with no hypertrophy or dilatation, not transmitted and with no accentuation of other valves. Moreover the pulse should be regular in rate and rhythm.

In the hope that there would be enough data to justify at least two investigations of functional heart murmur, the companies were asked to distinguish between murmurs at the base and at the apex. The murmurs at the base were to be further subdivided into—

Murmurs heard best at the right side of the sternum.
Murmurs heard best at the left side of the sternum.

The types of heart murmurs might be better summarized by—

Basic Systolic Murmurs { Right side / Left side }
and
Apex Systolic Murmurs.

Unfortunately, the amount of material contributed to the committee did not justify a division into the foregoing groups. The cases entering into the investigation numbered 4,286, with an average duration of about four and three quarter years and an average age at issue of 30—a younger average age by several years than in the general business of the contributing companies. This may be due to the practice of the companies of declining such risks at the older ages and also perhaps to a larger proportion of functional heart murmurs at the younger ages.

In the paper on Heart Murmurs by Rogers and Hunter (*T. A. S. A.*, Vol. XX, p. 83) the experience of the New York Life Insurance Company on functional heart murmurs was given. As the data were not numerous the authors included cases presenting a history of dyspepsia, muscular rheumatism, one case of

tuberculosis in the family history, and a few other similar minor impairments. Such cases have been excluded from the present investigation. The New York Life experience showed a ratio of actual deaths to expected deaths by the M.-A. Table of 114 per cent., but it was stated that this ratio would have been slightly less if the cases showing minor impairments other than a functional heart murmur had been excluded.

The following shows the experience of the companies contributing to the investigation, the expected deaths being calculated by the Medico-Actuarial Mortality Table (Select):

FUNCTIONAL HEART MURMURS.

	Actual Deaths.	Expected Deaths by M.-A. Table.	Ratio of Actual to Expected Deaths.
Insurance years:			
1–5	64	67.7	95%
6–10	31	27.6	112
11 and over	11	14.4	76
Total	106	109.7	97%
Ages at issue:			
15–29	45	52.3	86%
30–44	42	41.2	102
45 and over	19	16.2	117
Total	106	109.7	97%

The foregoing confirms the general opinion that functional heart murmurs are of little significance among young applicants, but that among applicants over, say, 40 years of age an extra mortality should be expected.

There were 26 deaths from heart disease among the 106 deaths, which is four times the normal death rate from that disease. In order to avoid misunderstanding, however, it should be stated that the principal additional death loss from heart disease occurred above age 35 at entry.

The investigation appears to show that probably some real cardiac murmurs were included among the supposed functional cases. This would explain the higher mortality and the heavy death rate from heart disease at the older ages at entry.

Intermittent Albuminuria.

There were 2,661 cases which entered into the investigation of intermittent albuminuria, of which there were 58 deaths. The average duration was about three and three quarter years and the average age at entry was less than 29—a very low average age. The following are the results:

	Actual Deaths.	Expected Deaths by the M.-A. Table.	Ratio of Actual to Expected Deaths.
Insurance years:			
1–5	35	34.6	101%
6–10	17	12.5	136
11 and over	6	6.2	97
Total	58	53.3	109%
Ages at entry:			
15–29	23	27.2	85%
30–44	22	18.9	116
45 and over	13	7.2	181
Total	58	53.3	109%

The following were the limitations with regard to intermittent albuminuria:

A. The risks reported in this study shall be free from any other important impairment.

B. Only those cases shall be included in the study which have shown albuminuria on more than one occasion where the tests used have conformed to the standards adopted by the Medical Directors' Association.

C. In determining the status of any case, facts of record (M. I. B.) within a period of six months before the date of the application, shall be taken into account.

D. All cases of albuminuria due to gonorrhoea shall be excluded.

E. Any case complying with one of the following formulae shall be regarded as one of intermittent albuminuria: (A = albumin found on examination. O = none present).

A A O
A O A
O A A
A A O O
A O A O
A O O A
O A A O
O A O A
O O A A

So far as such a small amount of material can be a guide, it appears that intermittent albuminuria is not a serious matter at the younger ages, but at the older ages of entry a higher mortality than the normal may be expected. This increasing relative mortality with advancing age is in accordance with the statistics of Rogers and Hunter (*T. A. S. A.*, Vol. XVIII, p. 239) on cases of albumin found persistently or on more than one occasion.

The number of deaths from nephritis was 6, which is markedly above the normal proportion of deaths from that disease.

It is suggested that there may have been included among the cases of intermittent albuminuria some cases of real nephritis, and this would probably affect the mortality more seriously at the older ages. The chief problem which the companies have to solve in connection with albuminuria is to eliminate cases of real nephritis which are beginning to show by intermittent albuminuria. The free use of the microscope to exclude cases having casts and red blood-cells, and the determination of the urea percentage would be factors in making this differentiation.

The only other investigation of intermittent albuminuria which has appeared is that by Dr. Ogden of the Metropolitan Life Insurance Company (*Proceedings of Association of Life Insurance Medical Directors*, 1915, p. 132). His investigation cannot be properly compared with the present study. He presented seven albuminuria groups, but he stated that in six of these there was the "slightest possible trace," and that in one there was a "very slight trace of albumin." It is evident, therefore, that his cases are not homogeneous with those in the present investigation, which included only cases showing albumin on more than one occasion and excluded those showing a faint trace.

The investigations of the Metropolitan Life, New York Life, Equitable, Penn Mutual and Prudential (on declined applications), and Northwestern Mutual, as reported in the *Transactions of the Actuarial Society of America* (Vol. XVIII, p. 239, Vol. XIX, p. 113, 115, 121), and in the *Proceedings of the Association of Life Insurance Medical Directors* (1915, p. 132, 186), and the results of the Medico-Actuarial Mortality Investigation, indicate that the mortality from albumin depends upon the following factors:

1. Is it accidental, intermittent or constant?

2. Is it a very faint trace, a faint trace, a moderate amount, or a large amount?

3. Is the selection severe or liberal? Did the company accept the cases in its standard class or on substandard plans?

4. Was the examiner skillful in making the analysis, and what degree of refinement was used in the analysis?

In conclusion the committee would like to express its opinion that *intermittent albuminuria* is of comparatively little moment at the younger ages, but of significance at the older ages of entry, and that the mortality of 109 per cent. for the whole group should not be considered as applying to all types of intermittent albuminuria, as the mortality is likely to be lower than that percentage when a faint trace was found infrequently, and distinctly higher than 109 per cent. when there was a marked showing of albumin at more frequent intervals.

III.

The Influence of Family History on Mortality. (1921).

One of the questions which the joint committee of the two societies was asked to consider was the Influence of Family History on Mortality. Each of the nine companies represented on the committee was invited to contribute its material for such a study. The larger of the companies were called upon for the data on 1,500 cases each, and the smaller companies on 750 cases. As material at the older attained ages was necessary in order to measure the effect of a strong or of a weak family history, it was decided to commence with the policies issued in 1880. Each company contributed a percentage of its experience on the issues for each year from 1880 to 1915, inclusive. These cases fairly represented each company's experience. From this material all cases in which there was a history of tuberculosis in the parents, the brothers or sisters, were excluded.

The data thus brought together were divided, on the basis of their family histories, into the following five groups:

A. Very Good
B. Good
C. Average
D. Poor
E. Very Poor

After several unsatisfactory attempts had been made by the committee to establish adequate standards by which to determine the group to which each case belonged, it was finally decided to leave the determination to the judgment of the medical director and the actuary of each contributing company. In the course of this work a number of difficult cases were referred to the committee for discussion, and in addition to this several medical directors conferred on the subject.

The committee measured the data divided into the five classes by the Medico-Actuarial Mortality Table (Select). The result was disappointing, as the ratio of actual to expected deaths did not

show a smooth progression from "Very Good" to "Very Poor." The officers of two companies offered to revise their experience, which showed inconsistent results. Besides this, some additional material was added in order to strengthen the testimony of each group. The results of the second investigation showed hardly any difference from the first.

A member of the committee then undertook to make an independent investigation, using for that purpose certain of the data which were readily available. Each case was rated from — 25 to + 35, according to a definite rule with regard to the ages at death of the parents, their causes of death, and the ages at death of the grandparents. Where the cause of death was heart disease, paralysis, or some other disease which, according to definition, was considered a "blemish," a penalty was charged. In this study, however, the ages and causes of death of the brothers and sisters were not considered excepting in the case of a "blemish." In two of the companies, however, the "unblemished" experience on favorable family histories was quite poor and this section of the material was excluded. This painstaking investigation showed a progression in the ratio of actual to expected deaths from the "Very Good" on the one hand to the "Very Poor" family history on the other hand. This progression, however, was so rapid that the committee doubted whether the results were a true expression of the effect of family history or included other factors. It was also thought likely that the exclusion of part of the material of certain companies had contributed largely to the results disclosed.

After careful consideration the committee concluded that further work on the investigation was inadvisable at the present time, but the members decided to submit to the societies a brief statement of its endeavors and of certain points which were brought to their attention in the course of the study.

In the early days covered by the investigation family history was looked upon as a far more potent influence than it is now believed to be. In fact, one of the early writers stated that "he looked upon hereditary influence as the first and most important factor in assessing the value of the life of an individual." It was evident from our study that in many instances a very good family history had at that time been considered as an offset to an impairment such as overweight. On the other hand, persons with a poor or a very poor family history had been selected with great care. Under the

conditions, therefore, which prevailed twenty or more years ago, the mortality among persons with a very poor family history might not differ materially from that among those with a very good family history, if the selection among the former were severe and among the latter lenient.

To meet this difficulty it was suggested that the cases be reviewed, and that all those be eliminated in which it had been evident that the very good family history was considered as an offset to an impairment of moment or where a very poor family history had been accepted by reason of the peculiarly favorable circumstances in other respects. This procedure would have involved such an amount of labor that the committee did not feel disposed to undertake it, especially as there would be great difficulty in allowing for the more rigid selection in cases with a poor and a very poor family history.

After seriously considering the matter the committee came reluctantly to the conclusion that there was not now available any data in which the same degree of rigidity of selection had been applied without regard to whether the family history was very good, very poor, good, or poor. There is now in existence material of this sort, but it is not more than ten or twelve years old, and accordingly unavailable for use in determining the effect of family history at the older attained ages. The committee therefore decided that the investigation should be postponed until material of a homogeneous nature becomes available.

JOINT COMMITTEE.

From the Actuarial Society of America:	*From the Association of Life Insurance Medical Directors:*
John K. Gore	E. W. Dwight
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Arthur Hunter, Chairman	Oscar H. Rogers
Henry Moir	Brandreth Symonds
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A. A. Welch	Thomas H. Willard

Book Reviews and Notices.

Supplement to the Eighty-first Annual Report of the Registrar General of Births, Deaths and Marriages in England and Wales. Report on the Mortality from Influenza in England and Wales during the Epidemic of 1918–19. H. M. Stationery Office, London, 1920. Pp. 119.

Report on the Pandemic of Influenza, 1918–19. No. 4 of Reports on Public Health and Medical Subjects. Ministry of Health. H. M. Stationery Office, London, 1920. Pp. xxiii + 577.

The first of these volumes comprises the official record of the course of the influenza epidemic of 1918–19 in England and Wales. It deals with (i) the method of estimating the total number of deaths in England and Wales due to the epidemic; (ii) age distribution; (iii) course and local distribution of the epidemic; (iv) relation to general health conditions; and (v) secondary causes of death.

The Ministry of Health report is an exhaustive study of the pandemic as a whole in all its aspects and throughout the world. This report is divided into two main sections, in addition to a comprehensive introduction and a number of appendices. The two main sections deal respectively with Influenza in Great Britain and Ireland, and Influenza in Foreign Countries. The former of these sections includes chapters dealing with the following: History of Influenza in England 1658–1911, Study of the 1918–19 Epidemic, Clinical Features, Bacteriology, Infectivity, Immunity, Meteorological Conditions, Domestic Overcrowding, Prophylaxis, and General Epidemiology. The latter section consists of a résumé of all available statistics or information regarding the incidence and intensity of the epidemic in nearly all foreign countries, from the greatest to the smallest, each being dealt with in a separate sub-section. Together these volumes probably form the most complete study of epidemic influenza which has yet been made, a study which, while largely of a medical nature, is of the utmost interest and importance to actuaries, and, indeed, to all connected with the business of life insurance, since (as was pointed out by Mr. J. D. Craig and Dr. Dublin, in opening their valuable

paper* on this subject) no catastrophe has ever tested life insurance companies as did the influenza epidemic of 1918. A review in some detail of the contents of these important publications is, therefore, appropriate, especially since the experience of Europe, at least in recent years, is closely paralleled by that of the United States.

The influenza pandemic of 1918–19 ranks third in magnitude among the great pestilences of the world, being surpassed only by the black death of the fourteenth century, and the great fifty-year plague of Justinian's reign. In a few months it destroyed more human lives than were lost in the whole of the five years of the European War. How many lives were lost will never be known, since no complete statistical records are available in certain countries, which were doubtless among those most affected, such as China and Russia, but there is little doubt that the total considerably exceeds ten millions. When it is realized that in British India alone the death roll was five millions, this figure will be admitted to be conservative. The epidemic was world-wide. It spread to all classes of society, civilized and uncivilized. In civilized countries, it was attacked by the skill of expert physicians, while in Nyassaland, the natives attributed its ravages to witchcraft, and resorted to "ordeal by poison."

The following table shows very roughly the number of deaths estimated to have been caused by the epidemic in various countries throughout the world, together with their approximate population. Some of the figures are little better than guess-work, but estimates are given only where there has been some statistical basis (in whole or in part) for them:

Country.	Approximate Number of Influenza Deaths.	Approximate Population.	Deaths per 1000.
United States	450,000	100,000,000	4.5
Great Britain and Ireland	230,000	45,000,000	5.1
France	200,000	42,000,000	4.8
Germany	400,000	60,000,000	6.7
Spain	150,000	21,000,000	7.1
Canada	30,000	7,000,000	4.3
Mexico	400,000	16,000,000	25.0
Australia and New Zealand	15,000	6,700,000	2.2
Union of South Africa	140,000	6,000,000	23.3
India	6,000,000	315,000,000	19.1
Japan	250,000	77,000,000	3.2

* *T. A. S. A.*, XX, page 134.

The report deals not only with countries where statistical records of the epidemic were available, but with all countries and with many other lesser divisions. Where no figures are available, whatever information as to dates, incidence or prevalence, could be obtained, have been set forth.

History of Influenza Epidemics.—There is no doubt that epidemics of influenza have been occurring for many centuries, although the difficulties of clinical identification of outbreaks prior to the nineteenth century, render observations before that time of doubtful value. The records of reliable observers are, however, sufficient to establish the fact. The principal features which enable identification to be made are, first, the rapid evolution or "explosive" character of the attack; second, the low fatality, and, third, the divergence of symptoms. As regards the interval between outbreaks there is little regularity and no conclusion is possible which might enable even an approximate forecast to be made for the future.

One important result of the early observations is the conclusion that prior to an epidemic there is gradually created a so-called "influenza constitution" favorable to the outbreak of influenza. This is manifested by a difference in the epidemiological features of the cycles of years in which influenza epidemics occur. The old observers noted an abnormal prevalence of "intermittent" fevers and nervous diseases in these cycles which has been borne out in recent times and to some extent in connection with the recent epidemic, although nothing more can be said with certainty than that the quality of diseases affecting the population prior to the epidemic was abnormal.

The influenza experience of the nineteenth century displays as its most striking feature the extraordinary and sudden increase in prevalence which took place following the epidemic of 1889–91. In 1847, there was a pandemic of the first order, after which the influenza death rate returned to normal (*i.e.*, for England and Wales, very roughly, about 50 per million per annum). After some minor disturbances, the world-wide outbreak of 1889–91 took place, following which the influenza death-rate remained at a new normal level of about 250 per million, and has shown no tendency to decline ever since. Probably the increase has in reality been gradual, although precipitated by an outbreak of great severity. The most plausible reason suggested for such an in-

crease is that it is due to the steady increase of movement and intermingling due to the improvement in the means of transportation by railways, tramways and subways. Another suggestion is that the decline of the tuberculosis death rate leaves exposed many phthisical persons to whom influenza is known to be particularly deadly. Whatever the reason, it seems as if the causative organism of influenza acquired, about the end of the nineteenth century, an increased diffusibility to which was added, in 1918, some further modification in the direction of increased virulence which entirely altered its character and enabled it, for the time being, to overwhelm all but strong resistance. Such theories are, of course, merely unestablished speculations, which may be upset by further research. The problem of influenza has not yet been solved.

Features of the 1918–19 Pandemic.—As indicated in the preceding paragraph, the recent pandemic differed from all previous outbreaks in respect of virulence. The death-rate surpassed anything previously experienced. Thus, in England and Wales, in the epidemic of 1847, the influenza death rate was 450 per million, in the 1890 epidemic it was about 600 per million, but in the 1918 epidemic it exceeded 3000 per million. Scarcely of less interest or importance was the extraordinary change in the age incidence. From being a comparatively mild disease of the very young and the old, influenza became, overnight, as it were, a highly fatal disease of the young and those in the prime of life. This change in the type of age distribution is strikingly shown by the Registrar General's figures showing that the proportion of influenza deaths at ages 0–5, changed from a normal of 10 per cent. of the total influenza deaths, to 25 per cent., and at ages 15–35, from 10 per cent. to 45 per cent., while at ages 55 and over, the proportion fell from 65 per cent. to less than 10 per cent. It seemed, it is stated, as if the chances of a man of 55, stricken with the disease, were better than the chances of a man of 25 or 30. Experience in America was the same, as is shown in the paper by Craig and Dublin already referred to.

The explanations offered for this striking change are not very satisfactory. There is no evidence in point of time that the change of incidence was other than entirely characteristic of the epidemic period only and not at all characteristic of previous epidemics nor of recent non-epidemic years. The experience in this respect of even the months of 1918 preceding the explosion was totally

different and between the epidemic waves there was a marked tendency for the age distribution to return to normal. One explanation of the abnormal age incidence, is that there had been for some years numerous aggregations of young people due to the war, the men in camps and barracks, the women in munition factories. But this condition had existed in some countries for several years before the outbreak of the epidemic, and, moreover, the epidemic occurred in all countries and not only those in which such aggregations were taking place. Also, such a condition arose gradually, while the epidemic burst with explosive force, almost without warning, attaining its maximum in a few weeks. It is, however, significant to note that the change in age incidence began to show itself before the actual storm broke. It is more likely that the real cause of the change lies in some as yet unknown change in the causative organism itself.

In addition to its fatality and its abnormal age incidence, the recent outbreak was characterized by an epidemic wave-form. A bird's-eye view of the course of the epidemic throughout the world leads to the conclusion that although all the waves were not felt everywhere, nor at precisely the same time, nor with the same degree of intensity, there were, in fact, three separate waves belonging, respectively, to the late spring or summer of 1918, the autumn of 1918 and the winter of 1918–19 or spring of 1919. In England all three waves were experienced in a marked degree. In the United States the first, *i.e.*, the spring or summer epidemic of 1918, was scarcely noticeable and can only be traced by the undoubted excess noted in many places in March and April, 1918. This excess was, however, unimportant, and entirely disappeared during the summer. The second wave, that of September or October, 1918, was practically world-wide, and its features were the same everywhere. The third wave was also almost universal. It was of the same nature, but of less violence than the second wave. The characteristics of the first wave were entirely different from those of the other two. The change in age incidence referred to above was not so pronounced as it afterwards became, and, what is much more important, the disease itself was of an immensely less fatal type. It was extensive and acute, but non-fatal. The disease of the second and third waves, on the other hand, was not only extensive and acute, but highly fatal. There were thus two distinct types of influenza encountered in the

course of the epidemic. It is interesting to look at some of the characteristic features of the two types, although perhaps this may be somewhat beyond our immediate field of interest.

Description of the Disease.—The main symptoms of the first type were prostration, rise in temperature, and headache. The fever ran its course in about three days and, in the absence of complications, recovery took place in about a week. Practically nothing in the way of treatment, apart from ordinary care and rest, was of any advantage. In the United States open-air treatment showed the benefit of fresh air and sunshine and gave favorable results.

The second type of influenza, which may be considered as being the true epidemic disease, so far as damage done is concerned, was of a much more sinister nature. Cases of this type developed pneumonic symptoms, and of those, about 40 per cent. died. Not all of the cases of influenza which occurred in the fall and winter epidemics, were of this type,—probably not more than 20 or 30 per cent., in fact; but in these epidemics no case could be regarded as in the "mild" category until it had actually recovered, since the pulmonary complications were apparently liable to set in at any moment without warning. Dr. French, who describes the clinical features of the epidemics, says, regarding this type:

"A patient might have been ill a day or two with mild influenza and seem to be progressing well; in an hour or two the whole picture might change, and twenty-four hours later the patient might be dead. During the epidemic, therefore, every case had to be regarded as in grave danger."

One of the most characteristic and striking features of this type of the disease was the "heliotrope cyanosis" or blue coloring of the face. This symptom was apparently of the utmost significance. Regarding it, Dr. French says:

"It was when this dreaded *heliotrope cyanosis* appeared that one knew that the prognosis had now altered so completely that the patient was almost certain to die; a small percentage of cases managed to recover . . . but the great majority succumbed . . . it was amongst cases of this type that the great mortality of the epidemic occurred."

And again:

"One could pick out those who were going to die with almost uniform certainty by reason of their color alone."

It is interesting to note that this blueness of the face did not arise, as might have been supposed, from failure of the heart, but was caused by the cutting off of the supply of oxygen to the blood. It did not, however, yield to any oxygen supply treatment, although this was extensively tried. No treatment in fact had any important effect on the progress of this type of the disease.

The Registrar General's report gives some interesting information as to the chief secondary causes of death associated with influenza, which may be summarized in the following table:

CAUSES OF DEATH CERTIFIED IN ASSOCIATION WITH INFLUENZA DEATHS. (PER 1000 DEATHS).

Cause.	First Wave.		Second Wave.		Third Wave.	
	Rural Districts.	Urban Districts.*	Rural Districts.	Urban Districts.*	Rural Districts.	Urban Districts.*
Tuberculosis.....	2	3	19	18	18	17
Heart Disease.....	69	68	29	32	38	39
Bronchitis.....	80	107	76	82	116	114
Pneumonia.....	480	561	716	721	616	642
No other cause.....	165	137	103	97	132	123

* Excluding London and County Boroughs.

The features shown by this table are:

(i) Similarity of Rural and Urban Districts;
(ii) Increase in Tuberculosis after First Wave;
(iii) Decrease in Heart Disease and Bronchitis after First Wave.

Origin and Cause.—The questions of the source of origin of epidemic influenza and its cause are of great interest. In 1918, the disease was very commonly believed to have originated in Spain, and for that reason became known as the Spanish Influenza, but this was an error, as outbreaks were occurring in other countries at the same time as the disease was first observed in Spain. There seems to be some ground for believing that China is the home of the disease, which is transmitted to Europe via Asiatic Russia, thus initiating the supposed route of infection from east to west. The theory that in the late epidemic the movement was from east to west was held by Craig and Dublin, who claimed to illustrate it by the sequence of dates of maximum mortality in a number of American cities. This does not appear, however, to be entirely conclusive, as the disease might be present

in a city for several weeks before attaining its maximum intensity, there being very little regularity in the interval between first infection and point of maximum mortality. Again, the worst period of the epidemic was, approximately, the same in point of time (viz., October, 1918), in such widely distant places as China, England and the United States. In England the direction of movement seemed rather to be from north to south.

As regards the *cause* of influenza, the old theory was that the disease was miasmatic in origin, *i.e.*, that it was transmitted through the atmosphere. Influenza is now, however, universally admitted to be caused by some living organism, either alone or in combination with others. The identity of the primary organism has not as yet been completely established. In order to establish identity it would be necessary to isolate the organism, cultivate it and reproduce the disease by inoculation. In 1892, Pfeiffer, a German bacteriologist, discovered an organism which has apparently, so far, the greatest claim of any to be regarded as the causative organism of influenza. Pfeiffer demonstrated the presence of this organism, now known as the Pfeiffer Bacillus or Bacillus Influenzae, in the cases which he examined and also successfully cultivated it. He did not, however, establish the identity of the bacillus with influenza by reproduction of that disease. It was, nevertheless, considered by many, at that time, in the absence of further opportunity for observation, that he had made out a good case.

The opportunity for testing the identity of the Pfeiffer Bacillus did not come until the late epidemic, and the results have been far from conclusive. Professor Andrewes, who contributed the bacteriological chapter of the Ministry of Health report, says regarding it:

"There is a striking lack of unanimity in the opinions expressed by different workers in different countries and it may be added, at different periods of the epidemic. Competent bacteriologists in France, America, Germany and a few in this country either failed to find the bacillus or found it in a proportion of cases so small as seriously to damage its reputation . . . On the other hand many British bacteriologists . . . were able to find the bacillus in so many cases that they were convinced of its aetiological rôle in the disease."

Attempts to convey influenza by spraying with pure cultures of Pfeiffer's bacillus failed, and the value of vaccines which contain

it as an element is at least doubtful. It is by no means, therefore, established that the bacillus is the primary cause of influenza, but Professor Andrewes remarks that it is admittedly responsible for a large proportion of the fatal pulmonary complications and that it may even yet be established as the primary cause.

Relation of the Disease to Social and Sanitary Conditions.—One of the most perplexing questions which has been raised by the epidemic is: What effect, if any, do social and sanitary conditions have on the prevalence and intensity of the disease? Craig and Dublin, it will be remembered, showed from the experience among different classes of policy-holders in the Metropolitan, that "those who were best off suffered least," and they say, "we are justified in concluding . . . that living and working conditions have played an important part in determining the amount of increased mortality." This evidence is excellent, but it appears to stand almost alone. It was shown in the discussion in that paper, that it was not even borne out in the experience of a very similar insitution (the Prudential). Moreover, the fact that negroes appeared to suffer less than whites, was apparently inconsistent with the former conclusion, since the general social and sanitary conditions among the negro population are, doubtless, inferior to those among the white population.

The reports under review do not sustain the former opinion. This result was so surprising and unexpected that it was subjected to the closest scrutiny. The Registrar General concludes that apparently the epidemic fell "alike on the sanitarily just and unjust." In 1847, it had been shown that the excess death-rates for the least healthy boroughs of London were much higher than for the healthy, but a similar tabulation for 1918 showed very little difference. Thus, in 1847, the healthiest borough (measured by normal death rate) had an excess influenza death rate of only fifty per cent. of that of the unhealthiest, while for 1918, the healthiest had an excess of eighty per cent. of that of the unhealthiest. This question was also examined from the point of view of over-crowding and with the same unlooked for result. It had previously been shown that both the tuberculosis death rate and the measles death rate showed high correlation with the number of inhabitants per room, but for influenza (which is said to rank, as regards infectivity, with measles, scarlet fever . . . and smallpox) no association between either number of persons per family

or housing density (*i.e.*, number of persons per room) and the attack rate of influenza was established.

It is true that there exists some evidence to the contrary in addition to the statistics of the Metropolitan. Thus, a report on the experience of the City of Paris (France) says, "overcrowding and insufficiency of housing are principal factors of the frequency and gravity of influenza." The Ministry of Health report, however, doubts if the facts warranted the foregoing conclusion and by applying the usual methods to obtain correlation coefficients apparently shows a reverse result. Again, in America, it was shown that civilians had a much lower mortality than soldiers in cantonments or students in barracks or in colleges and universities, and that, other things being equal, the mortality was higher among groups of men who slept many in a room. It is reasonable, in a general way, to suppose that poor living conditions and overcrowding must have an adverse effect in regard to an infectious disease such as influenza. The strong evidence to the contrary is but one of the mysterious and almost inexplicable features of the outbreak. Probably the correct conclusion is that the elements of over-crowding, etc., are not factors of the first order of importance and "the natural infectivity of the germ may be so high that the necessary exposures and contacts of *all* persons living under urban conditions are sufficiently numerous to provide opportunities of transfer so effective that any increase above the average is relatively a factor of negligible order."

Infectivity and Immunity.—Closely related to the foregoing are the questions of infectivity and immunity. That influenza is an infectious disease seems beyond question in view of the occurrence of secondary cases, the multiple distribution of cases by houses, and the mass of clinical observations. Open coughing or sneezing by infected persons was probably the most frequent cause of the spread of the disease and one of the principal steps taken by public authorities in the combating of the epidemic was the suppression of such actions by appeal to the public or even by appeal to law. On the other hand, experimental efforts in the United States to convey the disease to volunteers by having infected persons cough directly in their faces were uniformly unsuccessful. Very little has yet been learned about the nature or degree of infectivity of influenza except that it probably is conveyed in the manner referred to and also that the infectivity is

greatest in the early stages of the disease and possibly exists even before the disease has demonstrated its presence by causing physical discomfort.

The subject of natural immunity and the protection conferred by a previous attack of influenza received very exhaustive study in view of its importance in connection with determining the value of inoculation. The method of determining the immunizing value (if any) of a previous attack was to examine the experience of certain districts and of certain schools in which influenza censuses of more than one wave had been taken. If one of these units showed that of a total of $M + N$ persons, M previously attacked and N not previously attacked, the difference between the proportions attacked in the epidemic (or wave of the epidemic) under consideration in each of the two classes represented by M and N varied considerably from the normal or "probable" fluctuation, then some evidence as to immunity by previous attack, might be argued. If, on the other hand, the M and N groups suffered in the same proportion in the second attack, or if the proportions were within the probable fluctuations, there was no evidence of such immunity. These proportions and probable fluctuations were computed for about a dozen units, but with inconclusive results. The author (Dr. Greenwood) says:

"Although we may be reasonably certain that the advantage—however measured—of those previously attacked is in a majority of instances a real phenomenon, the results as a whole are unsatisfactorily discordant."

In other words, there is as yet no proof that a previous attack supplies any measure of immunity, although the probability is that it does.

Besides the possibility of immunity by previous attack, there is the question of immunity by inoculation. In England the Board of Health supplied a vaccine, but apparently did so only at the eleventh hour and almost as much in order to satisfy the public demand that it do something, as from any belief in the value of the vaccine. There is very little evidence that this vaccine was of any more than slight effect, although it is claimed that the attack rate was lower among those inoculated than among the uninoculated. This appears to be, however, a case where "doctors disagree." As has been already mentioned, it was shown that the primary causative organism of influenza has not yet been

identified. There are many strains of the infection caused by different organisms or by different strains of the primary organism and the probability of a vaccine of a given composition being effective is correspondingly reduced. In the words of the report, a naturally acquired immunity (*i.e.*, by previous attack), is often a valuable safeguard, the existence of which is a justification for the further study and application of artificial immunization (*i.e.*, by inoculation), but the communal value of any immunization process is not sufficient to be likely to prevent recurrence of epidemics in the future of the surviving generation.

There is apparently a further incentive to the study of artificial immunization in the claim made by Professor Andrewes, that those inoculated showed much less liability to the serious pulmonary complications which, it will be remembered, form the characteristic feature of the fatal type of the disease.

Prevention.—In discussing the treatment of the disease, the authors of the reports make it clear that in the case of influenza "prevention is better than cure," and consequently some space is devoted to the subject of prevention. The means of prevention which have been proposed may be said to be of three classes, viz., vaccines, drugs, and general sanitary and precautionary measures. The value of vaccines has already been referred to and the conclusion come to is that they are almost valueless because of the variety of types of organism. They have, however, the negative virtue that they can do no harm. Drugs are useless and not only useless, but may even be harmful. General sanitary and precautionary methods—the "non-mystical methods," as Dr. Greenwood calls them, in contrast to drugs and vaccines—are as yet the chief means of prevention to be relied upon. These are, principally, personal hygiene, nasal disinfection, the avoidance of crowds, especially in badly ventilated trains, tramways, etc., and the instruction in proper behaviour in public of those who may be infected.

The Future.—Apparently the outlook for the future is not encouraging. In summing up all the evidence, Dr. Greenwood says:

"... In the seeming conflict between man and his microscopic competitors there can never be a time when man is securely master of the universe. Intoxicated by the victories achieved over the plague (in Europe) over the enteric group, over typhus (in Western Europe) and over smallpox we are too apt to suppose that the campaign has ended in our favor. ... That we have just

passed through one of the great sicknesses of history . . . is an experience which should dispel any easy optimism of the kind. No instructed epidemiologist can say that the world may not have to endure, during the next half century, other plagues of the first order of severity."

His subsequent remarks indicate that influenza is likely to be among such plagues.

A Treatise on Probability. John Maynard Keynes. Macmillan and Co., Ltd., London, 1921. Pp. xi + 466.

The keynote of this work is struck in the preface: "In the intervening centuries (since Leibniz) the algebraic exercises . . . have so far predominated in the learned world over the profounder inquiries of the philosopher into those processes of human faculty which, by determining reasonable preference, guide our choice, that Probability is oftener reckoned with Mathematics than with Logic. There is much here, therefore, that is novel, and being novel, unsifted, inaccurate and deficient." The treatise gives the author's systematic conception of the subject from its Logical and Philosophical side. The book is divided into five parts; Part I is devoted to certain fundamental ideas; Part II, to a symbolical treatment of the subject and to the greater systematization, by symbolic methods on the basis of certain axioms, of the rules of probable argument; Parts III, IV and V, to the detailed treatment of the method of certain very important types of the probable argument of a complex kind—Part III, to the methods of Induction and Analogy; Part IV, to certain semi-philosophical problems and Part V, to the logical foundations of the methods of inference now commonly known as statistical. A long and carefully selected bibliography is appended. In referring to the bibliography compiled by Laurent and attached to the latter's "Calcul des Probabilités" the author states that Laurent's list is "unduly swollen by the inclusion of numerous items on Insurance and Errors of Observation, the bearing of which on Probability is very slight." This may be taken as an indication that the work is not one which will be of much interest or assistance to the actuarial student of mathematical probability.

Fourteenth Census of the United States, Vol. I., Population. Prepared by William C. Hunt, Chief Statistician, Washington, Government Printing Office, 1921. Pp. 695.

The fourteenth census of the United States was taken as of January 1, 1920, the change of date from April 15 being made at the request of the Department of Agriculture. As the work of the census proceeded, two bulletins were issued for each state, one dealing with the distribution of the population, and the other with color, race, sex, age and other matters. The present volume, which is the first of the customary series of the final census reports, comprises the consolidation of the first series of census bulletins (*i.e.*, those dealing with the distribution of the population by States, counties and other civil divisions), together with certain additional information as follows:

1. Certain groupings of states under the head of "Geographical divisions," viz., New England, Middle Atlantic, South Atlantic, East North Central, East South Central, West North Central, West South Central, Mountain and Pacific;

2. Population of individual cities and comparison of urban and rural territory;

3. Population of extra-continental United States Territory and Possessions;

4. Comparative figures for earlier censuses together with rates of increase, percentages and averages;

5. Illustrative maps and diagrams.

The population of the continental United States (48 states and the District of Columbia) at each of the last four censuses (which comprised the same area) is shown in the following table which also gives the percentage of increase:

Census of	Population.	Percent of Increase.
1890	62,947,714	25.5
1900	75,994,575	20.7
1910	91,972,266	21.0
1920	105,710,620	14.9

The population per square mile (of land area) has increased from 21.2 in 1890 to 35.5 in 1920, the most densely populated state being Rhode Island with 566.4 per square mile, and the least, Nevada with 0.7 per square mile. Only ten states have a population exceeding 100 per square mile.

The center of population (which means the "center of gravity"

based on distance of population from the center and not the numerical center or median point) continues to move westward, although at a less rapid rate, the extent of movement for the period 1910–1920 being 9.8 miles as compared with 38.9 miles at the previous census. There is also a trifling northward movement. The location of the "center" is now in Owen County, Indiana. The median point is located at Union City, Indiana, about 130 miles northeast of the "center."

Successive census figures have shown a constant tendency toward increase in urban, and decrease in rural population. This tendency continues to be evident, the proportion of urban population having increased from 45.8 per cent. to 51.4 per cent., and that of rural population having consequently decreased from 54.2 per cent. to 48.6 per cent. Rhode Island has the largest percentage of urban population and Mississippi the smallest. Since 1910, four cities (Buffalo, Detroit, Los Angeles and San Francisco) have passed the half million mark, and two others the quarter million mark, but no new ones have reached a population of one million, New York, Chicago and Philadelphia remaining the only cities in that class although Detroit falls short of it by less than ten thousand.

The A. B. C. of Life Insurance. Sixth Edition, Revised, Enlarged and Rewritten by Millard Keys. The Spectator Company, New York, 1921. Pp. 104.

This is one of the best of the smaller publications dealing with life insurance for the general reader. The new edition brings the book completely up to date, a task of some magnitude (as the previous edition dates from 1888) but one which has been well done. The subject matter is dealt with in a clear and readable manner and the book gives a good idea of elementary actuarial principles, as well as such more practical matters as Valuation with Allowance for Initial Expense, Disability Benefits, State requirements, Group insurance and so forth. The tables have been revised so as to suit modern conditions and the arithmetical examples are likewise brought up to date. The book should be valuable particularly to field men and other non-actuarial readers.

Introduction to Actuarial Science. H. A. Finney, American Institute of Accountants, New York, 1921. Pp. 101.

The subject matter relates entirely to compound interest and annuities-certain, which are dealt with in an elementary way suitable for those who require merely an outline of the subject. The treatment is clear and the examples are good. Most of the book has already been published in the *Journal of Accountancy.*

Third Party Insurance. M. P. Cornelius. The Insurance Field Co., Chicago, 1920. Pp. 297.

This book deals with the various forms of Liability and Compensation insurance. It also includes a brief description of all other classes of insurance.

The Medical Side of Field Work. Dr. William Muhlberg, Medical Director, Union Central Life Insurance Co. The Rough Notes Co., Indianapolis, 1920. Pp. 121.

Medical selection is discussed in a general way in the first six chapters, bringing out the agent's responsibility and attempting to explain for the benefit of the agent the reason for the different treatment of borderline risks by different medical directors. The remainder of the book is a rather complete review of the commoner forms of medical impairments, describing their cause, nature, and effect on mortality as shown by the Medico-Actuarial experience.

Second Report of the Committee on Foreign Inquiry, Social Insurance Department. The National Service Federation, New York, 1920. Pp. 164.

The contents of this Report consist of:

1. A brief review of European social insurance experience with particular reference to sickness insurance in Great Britain.

2. Special articles by individual members of the Committee, namely,

(*a*) The Low Level of European Compulsory Insurance;
(*b*) Social Insurance and the American Wage-worker;
(*c*) Proportions of the Indigent class in the Old World and the New, by James W. Sullivan—Labor Member of the Committee;
(*d*) A Study of Unemployment Insurance (British Ex-

perience), by P. Tecumseh Sherman, Attorney-at-law; and

(*e*) Proposed Swedish Sickness Insurance System, by Frederick L. Hoffman.

Mathematics for the Accountant. E. R. Vinal. Biddle Business Publications, Inc., New York. Pp. 172.

This book deals with compound interest calculations and is written primarily for accounting students. It includes interest tables and a great number of problems ranging from plain arithmetic to valuation of bonds.

Business Mathematics. E. I. Edgerton and W. E. Bartholomew. The Ronald Press, N. Y. 1921. Pp. 305.

Deals, *inter alia,* with Sales and Profits Statistics, Exchange, Taxes, Interest on Bank Accounts, Building and Loan Associations, Graphical Representation, Abbreviated Methods, Averages and Logarithms. The treatment is elementary.

Mathematics of Finance. H. L. Rietz. A. R. Crathorne and J. C. Rietz. Henry Holt & Co., New York, 1921. Pp. xiv + 280.

The primary object is to furnish a text-book for the use of college classes studying financial or business mathematics.

Four chapters are devoted to the theory of compound interest and annuities-certain, two to special applications thereof and three to the theory of life contingencies, including net premiums and reserves and three chapters are purely mathematical. The chapters on Depreciation and on Building and Loan Associations are interesting. The chief advantage of the book is in bringing together under one cover the matter usually required for college courses. The treatment is clear and there are numerous illustrative exercises and problems. It is not quite obvious why the mathematical chapters have been added. Without the elementary algebraical knowledge comprised in these chapters, the book could not be studied at all and it seems that such knowledge might be presumed. A more than usually complete set of interest tables (seven decimal places) is included, together with a few actuarial tables.

First Course in Statistics. D. C. Jones, G. Bell & Sons, London, 1921. Pp. 286.

A clear and readable introduction to the mathematical theory of statistics. The first part is largely non-mathematical, covering the principles of measurement, classifications, averages, dispersion, frequency distribution, graphical presentation and correlation. The second part is based on algebra and calculus and covers probable errors, curve fitting, including the use of Pearson's generalized probability curve and the method of moments, applications of curve-fitting, further discussion of the normal curve of error and frequency surfaces.

Readings and Problems in Statistical Methods. H. Secrist. Macmillan Company, New York, 1920. Pp. 427.

A compilation of short articles copied and adapted from diversified sources. It is entirely elementary and non-mathematical, dealing with the nature of statistical methods, sources and collection of statistical data, units of measurement, classification and tabulation, graphic presentation, characteristics of averages, index numbers and summarization, with brief references to dispersion and correlation.

(Reviewed by William O. Weyforth in *Quarterly Publication of the American Statistical Association*, March 1921, page 668.)

Other Recent Publications.

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Business Research and Statistics. George Frederick. Appleton & Co., 1920. Pp. 342.

Calculus Made Easy. S. P. Thompson. Macmillan Co., New York, 1921. 2nd Edition, Pp. 301.

Chart to Facilitate the Calculation of Partial Coefficients of Correlation and Regression Equations. T. L. Kelley. Stanford University Press, 1921. Pp. 24.

Consolidated Tables of Bond Values. Financial Publishing Com-

pany, Boston, 1921. Desk Edition. Pp. 663. (Net returns from 2.90 per cent. to 15 per cent. at dividend rates from 3 per cent. to 8 per cent. and periods of 6 mos. to 50 years semi-annually and 55 to 100 years quinquennially.)

Coupon Interest Tables. Financial Publishing Company, Boston, 1921.

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Elements of Statistics. A. L. Bowley. P. S. King & Co., London, Fourth Edition, 1920. Pp. xi + 459 *or* 2 vols.

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Foreign Exchange Before, During and After the War. T. E. Gregory. Oxford University Press, New York, 1921.

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Health and Accident Insurance Policies under the Standard Provisions Law. T. P. Nelson. Blied Printing Co., Madison, Wis.

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Meeting Objections. F. A. Stevenson. Harper Brothers, New York, 1921.

Practical Bank Operation. L. H. Langston. The Ronald Press Co., New York, 1921. 2 vols.

Principes de Statistique théorique et appliquée. Armand Julin, Marcel Riviere, Paris, 1921. Vol. I, Statistique théorique. Pp. xxiii + 712.

Problems and Solutions, Associateship Examinations. The Actuarial Society of America (Educational Committee), New York, 1921. Pp. 133.

Report on Pension Laws. Milwaukee Pension Commission, 1920. Pp. 103.

Riegel on Insurance. R. Riegel and H. J. Lohman, Prentice-Hall Co., New York, 1921. Pp. 500.

Sickness Frequency among Industrial Employees. U. S. Public-Health Service, Washington.

Statistics in Business. H. Secrist. McGraw, Hill Co., New York, 1920. Pp. 130.

Stumme's Time Calculator. E. C. Stumme & Co., Readlyn, Iowa, 1921.

Tables of Values of Compound Interest Functions and Logarithms of Values of Compound Interest Functions. J. W. Glover and H. C. Carver. G. Wahr, Ann Arbor, 1921. Pp. 77.

Teachers' Pension Systems in the United States. P. Studensky, Appleton Co., New York, 1920. Pp. 460.

The Fall of the Birth Rate. G. Udny Yule. Cambridge University Press, 1920. Pp. 43.

The Financial Policy of Corporations. A. S. Dewing. The Ronald Press Co., New York, 1921. 5 vols.

Tracts for Computers, (inter alia):

No. II. On the Construction of Tables and on Interpolation. Part I. Uni-variate Tables. Karl Pearson.

No. III. On the Construction of Tables and on Interpolation. Part II. Bi-variate Tables. Karl Pearson.

No. V. Table of the Coefficients of Everett's Central Difference Interpolation Formula. A. J. Thompson.

No. VI. Smoothing. E. C. Rhodes.

Cambridge University Press, II and III, 1920; V and VI, 1921.

Treatise on the Federal Estate Tax. R. D. Thurber. Bender & Co., New York, 1921.

Obituary.

William George Fitzgerald.

Born, October 1, 1874. Died, July 12, 1921.

WILLIAM GEORGE FITZGERALD.

Mr. William G. Fitzgerald was born in Toronto, October 1, 1874, and was the son of the late William Fitzgerald, for many years Superintendent of Insurance at Ottawa.

Mr. Fitzgerald was graduated from Toronto University in 1899 after a distinguished course in Mathematics. He was admitted as an Associate to the Institute of Actuaries in 1901 and to the Actuarial Society of America in 1906. For three years he was in the office of the London and Lancashire Insurance Company at Montreal; for eight years thereafter was actuary of the Independent Order of Foresters at Toronto and for the past ten years actuary of the Northern Life Assurance Company, London, Ontario.

In addition to his duties as actuary, Mr. Fitzgerald had latterly general oversight of the Head Office staff. During the critical war and epidemic periods his duties were discharged with ability and precision, with credit to himself and satisfaction to his company. He maintained throughout his career the highest ideals of the responsibilities of his profession and held in loyal friendship the staff with whom he was so closely associated.

Mr. Fitzgerald was possessed of a very kindly but retiring disposition. His interest in his home was intense and he made an ideal neighbor but never sought office or any public recognition of his splendid abilities. He died on the 12th of July, 1921, after an illness of but a few days.

Abstract From the Minutes of the Semi-Annual Meeting of the Actuarial Society of America, Held in Cincinnati, Ohio, on Thursday and Friday, October 27 and 28, 1921.

Union Central Building, Cincinnati, Ohio.

October 27, 1921.

FIRST DAY.

The meeting was called to order by the President, Mr. William A. Hutcheson, at 10:30 A.M.

The following members were present:

FELLOWS.

Alsop, D. G.
Bagley, W. N.
Barber, W. P.
Birkenshaw, J. H.
Bissell, C. R.
Blehl, E. M.
Breiby, W.
Buchanan, J. D.
Cann, F. E.
Craig, J. D.
Dark, T. A.
Dow, H. B.
Fackler, E. B.
Fassel, E. G.
Ferguson, C. C.
File, L. K.
Flanigan, J. E.
Gaylord, W. S.
Gibb, J. B.
Hardcastle, E. E.
Henderson, R.
Hoskins, J. E.
Howe, L. H.
Howell, V.
Hunter, A.
Hurd, H. G.
Hutcheson, W. A.
Johnson, M. L.
Johnston, F. H.
Kattell, S. C.
Kilgour, D. E.
King, W. I.
Koeppe, A. J.
Laing, J. M.
Laird, J. M.
Larus, J. R., Jr.
Linton, M. A.
Little, J. F.
McConaghy, C. A.
McKechnie, J. B.
Macaulay, T. B.
Macfarlane, W.
Maclean, A. T.
Marshall, E. W.
Mead, F. B.
Moir, H.
Morris, E. B.
Murphy, R. D.
Papps, P. C. H.
Parker, J. G.
Powell, J. M.
Rice, H. I. B.
Riley, A. J.
Rose, D. H.
Rutherford, C. D.
Rydgren, A. A.
Scott, J.
Sheppard, H. N.
Smith, F. M.
Speers, A. A.
Stilwell, S. E.
Strong, W. M.
Warters, D. N.
Watson, A. D.
Wolfenden, H. H.
Wood, A. B.
Wood, W. A. P.
Woodward, J. H.

ASSOCIATES.

Allison, S. E.
Angell, C. H.
Bain, W. A.
Benjamin, R. R.
Brown, J. C.
Bunyan, A. T.

Buttolph, H. W.	Hill, E. B.	Miller, I. A.
Carrington, J. R. L.	Jordan, F. R.	Moore, G. C.
Davenport, J. S., Jr.	Keys, M.	Porter, E. A.
Evans, P. H.	Larkin, H. F.	Reichgott, H.
Fairlie, J.	Lithgow, J. H. F.	Smith, V. R.
Fetsch, H. C.	Little, R.	Warwick, R. W.
Fisher, John W.	McCankie, R. C.	Washburn, J. H.
Grout, H. A.	McIntosh, J.	Washburne, A. C.
Halliday, W. R.	McLean, P. S.	White, W. C.
Hart, W. V.		

President John D. Sage of the Union Central Life Insurance Company gave a short address of welcome to the Society.

President William A. Hutcheson read his presidential address.

The minutes of the annual meeting held in New York on May 19th and 20th, 1921, were approved without reading.

The Secretary, Mr. Strong, stated that the three months' required notice had been given to the Fellows on April 30th, 1921, of a proposed amendment to the By-Laws of the deletion of the second paragraph of Article VI, which paragraph reads as follows:

"During the continuation of the war in which both the United States of America and the Dominion of Canada are engaged in the year 1917, the provision of Article IV of the By-Laws regarding payment of dues may be waived or suspended in the case of any member, upon a majority of vote of the Council."

A motion was made, and duly seconded, that the By-Laws be amended by the striking out of this portion. This motion was unanimously carried.

The Society proceeded to the reading and discussion of papers, which papers and discussions appear in this number of the *Transactions*. This occupied the remainder of the day except for an intermission for luncheon, at which the Society was the guest of the Western and Southern Life Insurance Company at its Home Office.

The Society adjourned at 5:30 P.M. to assemble for dinner at the Queen City Club at 7 P.M.

At the dinner President Hutcheson acted as toastmaster, and the speakers were Mr. George L. Williams, Vice-President, Union Central Life, Mr. Percy H. Evans, Mr. Colin C. Ferguson, Mr. Robert Henderson and Mr. John R. Larus, Jr.

SECOND DAY.

The meeting was called to order by President Hutcheson, at 10 A.M., and was devoted to the informal discussion of topics of current interest, as follows:

Business Conditions—Reconstruction Period after War.

(1) Some of the outstanding features at the present time, incident to the reconstruction period following the war, are (i) reduced volume of new business, (ii) increased surrenders, loans, and lapses, and (iii) an increase in the rate of interest on new investments. How are these and other factors due to the same cause affecting the companies, favorably and unfavorably, and what are the prospects of a continuance thereof?

(2) In determining the rates of dividend for the year 1922, what allowance should be made for these, as well as for the favorable mortality rates now in evidence, in view of the fact that these features may be of a temporary nature?

Mortality.

(3) What are the causes of the very low mortality rate so far experienced this year by life companies?

(4) To what extent is the decrease due to a diminution in deaths from specific diseases, such as pneumonia, influenza? Is the weather responsible for part of the improvement? Can any part of the improvement, particularly in industrial insurance, be traced to national prohibition?

Interest, Investments, etc.

(5) In view of the high rate of interest now obtainable, is it necessary or desirable (leaving statutory requirements out of consideration) to base the calculation of premium rates or reserves upon as low a rate of interest as 3% or 3½%? Should consideration be given to this in calculating annuity premiums?

(6) The rises in the interest rates during the last 20 years have generally resulted in increased policy loans and surrenders, thus preventing the life companies from obtaining the full benefit of the high interest rates prevailing at certain periods. Is this condition likely to characterize the future to a greater extent or to a less extent than in the past and what action, if any, should be taken to meet it?

(7) In the matter of investments, is the chief duty of insurance companies to their policyholders or to the public?

(8) Should a company having insurance in force in a foreign country carry the reserve on such insurance in securities of that foreign country (when not required to do so by the laws of that country) so as to avoid any effect of fluctuation in exchange?

Selection.

(9) Is it practicable in issuing new policies to make exceptions in favor of individual applicants who are following occupations generally treated as requiring an extra premium? If so, under what circumstances?

(10) In view of the XVIIIth amendment to the Constitution, the Volstead Act and the condition of prohibition enforcement, should there be any modification of the questions as to habits usually contained in the application blank? Should there be any additional questions? Has the situation as to liquor legislation in Canada induced any modification of the principles of selection formerly governing?

(11) In connection with reinstatements: To what extent should the standard of approval be modified because of duration of the original policy or because of extended insurance feature?

(12) In case of applicants rated up for overweight, would it be proper to grant Disability benefits, and if so, at what premium? That is, what relation, if any, should the rating for the Disability premium bear to the rating for the policy itself?

(13) Is the death rate from accidents among risks aged from 15 to 25 considerably heavier than that for the next ten years of age? If so, should life companies accept insurance with Double Indemnity provision on risks under 20? Should there be a similar limitation as to disability provision?

Changes.

(14) In changing a policy to a cheaper plan of insurance, what special allowance might be made on account of the larger premiums theretofore paid, especially if the policy has been in force so short a time as to have no guaranteed surrender value? What conditions should be attached to the granting of such allowance?

Laws, Taxation, etc.

(15) Is there any danger that life insurance payable to a beneficiary may be taxable under any Inheritance Tax law or special statute imposing taxes similar to inheritance taxes?

(16) Do future increases in taxes on life insurance companies threaten to seriously affect dividends to policyholders, or, in some cases, solvency?

(17) Has any ruling been given out by the Treasury Department as to the basis of calculation of the value of a Continuous Instalment or Life Income settlement for the purposes of Estate Taxation (Federal Statute)?

(18) Is it permissible and if so, practicable, for companies writing policies providing for Additional Accidental Death Benefits to reserve the right of subrogation in connection with its accident claims, as is done in certain other branches of insurance?

(19) In view of the recent changes in the incontestable statute of Illinois (whereby there are introduced the phrase, "during the lifetime of the insured" and an additional exception to the two-year rule in connection with "provisions and conditions relating to

benefits in event of total and permanent disability benefits and those granting additional insurance specifically against death by accidents"), what action should be taken with regard to present policy forms in order to protect the companies?

Organization.

(20) What are the relative advantages and disadvantages of a General Agency System as compared with a Branch Office System? Is it desirable for a company to use both systems, that is, to have some General Agencies and some Branch Offices?

(21) What are the principal points to be kept in mind by a life company in entering into an agreement with a bank or trust company regarding the issuance of policies in connection with savings deposit accounts?

Educational.

(22) Has any company given educational courses in insurance principles or practice to home office clerks (not actuarial students)? How have they been given and what have been the results?

At the termination of the informal discussion a vote of thanks was tendered to the Union Central Life Insurance Company for its entertainment.

At 12 o'clock the Society adjourned immediately to luncheon at the Country Club as the guests of the Union Central Life Insurance Company.

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